

BUSINESS MANAGEMENT

*Training and Service
for Executive Work*

*Problems of
Plant Management
** Organizing for
Control*

LA SALLE EXTENSION
UNIVERSITY
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BUSINESS MANAGEMENT

Executive Manuals 33 and 34

PROBLEMS OF PLANT MANAGEMENT—Being Execu- tive Manual 33, on Principles of Produc- tion, in a Complete Plan of Training and Service for Executive Work

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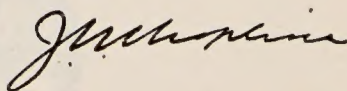
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PROBLEMS OF PLANT MANAGEMENT

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PROBLEMS OF PLANT MANAGEMENT

Part I

THE INDUSTRIAL SITUATION

THE two most basic divisions of business management are production and sales. Other divisions—finance, credits and collections, accounting, general office management—are all functions designed to facilitate sales and production. To produce and to sell what is produced are the two functions which stand out as fundamental divisions of business management.

The sales problem—how to attain the desired volume of sales at low cost—has been largely covered in preceding manuals. The production problem—how to attain the scheduled volume and quality of output at low cost—will be thoroly analyzed in Executive Manuals 33 to 40, inclusive. This analysis will uncover the basic principles of low-cost production as they are applied, primarily, in plant management. But nearly all the basic principles of efficient plant management are broadly applicable in handling other functions of business. We saw in Executive Manual 6, for example, how an office manager applied the principle of subdividing labor along job lines as a means of correcting errors in filing cards.

As we proceed with an orderly analysis of production problems and the principles applied in solving them, let us constantly relate these principles to our own daily problems, for they will suggest ways of doing many things better, and thus become an important tool for advancement. In fact, without a thoro grasp of the principles of efficient production, training for executive work in any department would lack one of its most vital elements.

Outstanding Plant Problems. What are the problems

of managing an industrial plant? The executive in charge of production will usually say that he is most concerned about—

1. Costs that justify good dividends and good wages.
2. The satisfaction, welfare, and efficiency of the personnel.
3. Competition, new products, and modern design.
4. Manufacturing processes and methods.
5. Production control.
6. Internal policies; division of duties and responsibilities.
7. Maintenance of and additions to equipment and buildings.
8. The finances tied up in inventories.
9. Satisfaction of customers gained by living up to promises and by rendering quality service.

Those are the outstanding problems of plant management. But, of course, there are many other problems that come up for attention daily and must be decided upon immediately, so as to keep the work moving along steadily, and without interruption.

Necessary tools or materials may not arrive on time and substitutes may have to be decided upon to fill in for the time being. Men sometimes quit for no apparent reason and delay important operations. A belt breaks and, if there is no reserve belt, production may be delayed for fifteen minutes or more until the belt can be repaired. Again, an order is shipped to the wrong man or the wrong town, or a defective product slips by inspection and is delivered in poor shape, to be later listed as "returned goods" in the stock room.

Such are a few of the many minor daily troubles of production management. But in spite of all these delays and interruptions, production proceeds and orders are turned out. The eye of management, while meeting all these minor problems, is kept focused on its outstanding problems. Slowly, perhaps, but surely progress is made toward improvement in handling those more important problems above outlined.

From Raw Material to Finished Product. Take almost

any manufacturing plant. We see raw materials being unloaded from the railroad cars; and we see the finished products being shipped to customers. The making of the product was carefully planned in advance. The raw materials were contracted for in advance. The designs had been decided on after careful investigation. The proper tools and equipment had been ordered and installed, the men were trained, and the requisite working capital had been provided.

Prior to this, the market probably had been investigated; perhaps a market analysis and survey had been conducted. An advertising campaign may have been launched. Production schedules had been planned to co-ordinate with sales. In general, well-balanced operations had been provided for in advance.

Such were a few of the many features of preparation for attaining a scheduled volume of output at low cost.

The problem of production is to attain that volume and quality of output which can be readily sold at a price which yields a satisfactory net profit.

This fundamental objective of production implies the attainment of low costs, especially so if selling prices are established against strong competition.

A Trip thru the Plant. Let us enter the plant. What do we see?

There is a mechanic about to finish a job. He is looking over the tools, materials, blue prints, and instructions for his next job, all of which have been brought to his place of work before his present job is finished.

At a desk marked "Materials in Process," a trucker is stopping with a partially completed job. A production clerk at the desk signs a printed slip of heavy paper, called a "ticket," and directs the trucker where to deliver the material.

The clerk thereupon shifts certain tickets in the pockets attached to a large board on the wall back of his desk,

marked "Dispatch Board." On inquiring what this means, the clerk tells us that this board shows the progress of operations on every job in the department. The tickets and receipts for each operation are forwarded to central recording offices within a few minutes after every change.

Next, we see the foreman of the department. He is laying down a paper marked "Daily Progress Report." He tells us that this report shows him the extent to which he is living up to his schedules of work and that he has also a report which shows him to what extent he is meeting the cost requirement on each job. All these records have been planned as a part of the work of the management.

Numerous as are the problems of control, with all their ramifications, the cool certainty with which the successful plant executive meets and solves his problems is little short of miraculous to the uninitiated. This certainty would be impossible had not the executive long ago analyzed and studied the principles of plant management as applied in efficient control of production.

Every Business Has a Production Problem. Broadly considered, there are four great classes of business enterprises, as follows:

1. The producing class—agriculture, mining, and manufacturing enterprises.
2. The transporting class—railway and steamship lines, canals, express companies, and local delivery.
3. The financing class—banking and bond houses, insurance companies, etc.
4. The distributing class—wholesalers and jobbers, retailers, brokers, agents, etc.

Each of these four classes of business has a production problem. Some of them produce services rather than products or commodities. But they have a production problem whether their output is a tangible commodity or an intangible service, such as bank credit or insurance.

In this part of our plan of training for executive work, we shall confine our attention primarily to the production problems of manufacturing, because the principles of production management have been most fully developed and applied in manufacturing practice. We want to understand these principles so thoroly that we shall readily see their application, and be able to apply them, to production problems in all four classes of business enterprises.

A Classification of Manufacturing. Manufacturing industries are classified as analytic (taking apart) or synthetic (putting together); also as having consecutive, simultaneous, or intermittent productive processes, or combinations of these.

Analytic manufacturing separates a raw material into its constituent parts, selecting and assorting them as leading products, by-products, and waste. The corn-products industry, oil refining, and lumbering are examples of analytical industries. Synthetic manufacturing builds up a compounded product out of simple raw materials, as in producing automobiles or furniture.

Consecutive processes are apparent in a cement mill, a hat factory, or a wall-paper factory; while simultaneous processes are apparent in an automobile factory, and intermittent processes are illustrated in the canning industry, where different fruits and vegetables have their season and require different apparatus and methods for some parts of the process.

Each class of industry presents its own peculiar conditions of plant location, layout, and equipment; of control of materials, processes, and costs.

The adaptation of management principles to any one class of industry requires distinct methods designed to fit that particular class.

These distinct methods will, in turn, affect the type or organization and methods of control employed.

The underlying principles of efficient management are the same in each class of manufacturing, but these principles can become effective only when applied thru a system and an organization which fully meets the particular requirements of the business under consideration.

So-called cut-and-dried plans cannot be used. A clear understanding of production principles, such as we are about to study, however, will enable us to devise systems and organizations which will be "tailor made" to fit our plants and businesses.

BALANCE IN MANAGEMENT

In an epoch-making paper on "Shop Management" delivered before the American Society of Mechanical Engineers some years ago, Frederick W. Taylor made the statement that the most outstanding fact in American industry is the "unevenness of management."

Mr. Taylor said that some industries have succeeded largely by reason of wise foresight in selecting their plant location; others by reason of their excellent equipment; others by reason of the excellence of their methods; others, again, by reason of their splendid industrial relations; and still others by reason of their excellent sales methods.

He predicted that as time went on, it would become necessary for each industry to become better balanced and to go at its problems in a more scientific way. In other words, it would become necessary to develop the highest possible efficiency, not in one or two, but in all of the success factors already mentioned.

Every executive needs the vision to show him the importance of each factor in organization, management, and control. Every executive and everyone who aspires to be an executive must see clearly in true perspective the whole field of business management, and be able to develop in his business or department all essential success factors which are combined in balanced management.

The Seven M's in Production. But before we further analyze the question of balance, let us make a simple classification of production activities, which will give us a bird's-eye view of the situation. Charles B. Going, in his *Principles of Industrial Engineering*, says that the industrial engineer has not only to deal with machinery, methods, and materials, but also with men, money, and markets. This classification is simple and important. Let us remember that—

Every production problem includes the seven M's—management, materials, machinery, methods, men, money, and markets.

Altho the works manager deals directly with materials, machinery, methods, and men, his control over production affects also, tho less directly, the fields of money and marketing. All those seven M's are involved in solving production problems. This is especially the case when we set out to balance production.

How Production Is Balanced. Production should be balanced as to—

1. Time—by proper scheduling of work.
2. Products—by selection of the most profitable lines.
3. Seasonal variations—by development of by-products or new “fill-in” products.
4. Plant capacity compared with the master plans and with the sales estimates, as well as with the financial requirements.

Let us get a clear understanding of each of those four factors as part of the problem of gaining balance in production.

Balance As to Time. In balancing the output of an entire industry or a single company as to time, definite master plans or monthly schedules of output are necessary in order to get the goods on the market at a specified time and according to the seasonal requirement.

In the men's clothing industry, for example, it is

extremely important that spring coats and suits are in the hands of retailers at least four weeks before Easter, so that the retailers can start their advertising and selling campaigns in due time. The summer suits (Alpaca, Palm Beach, Mohair, etc.) must be in the hands of the retailer at least three weeks before the warm season starts—and warm weather comes at different times in different latitudes. In Chicago territory, for example, fall coats and suits must be on the market by August 15, and the winter goods by September 15.

There must be a very fine balance of production to meet time requirements. Raw materials purchased from the mills must be received on time; the designer must work far in advance, so that styles are out for the salesmen; adequate working capital for financing production must be provided; quantity of output must keep pace with scheduled deliveries of finished product; rush periods must be avoided so far as possible.

This latter achievement requires application of an important principle of balance in production, as follows:

In so far as possible, peaks of demand must be anticipated; the production schedule must provide for adequate stock at all times, with a production rate as nearly constant as financial and other considerations permit.

Balance As to Product. One feature of balanced production as to products concerns the making of only those items and lines which are, everything considered, the most profitable to make. Expensive equipment should not be used in making nonprofitable lines. It is a basic principle of management to—

Avoid spending a great deal of time, energy, and money on such lines as do not yield a satisfactory return on the investment.

An advertising concern in planning a very extensive campaign for a manufacturer, asked for some definite information regarding each individual product, its cost,

and its place in the line. This inquiry started a special investigation of all of the products manufactured. It was found that about 90 per cent of plant capacity was spent either on comparatively small-profit or on nonprofitable products.

This manufacturer then changed his entire production plan. He eliminated the nonprofitable lines, and within a year he had almost doubled his profits.

In planning a sales and production schedule for a business, competition and other conditions may compel the manufacture of some items which show small net profits. While well-balanced management recognizes this fact, it will—

Push the sale of the more profitable items, and also seek to effect changes in both price and cost, which will increase the profit on the low-profit items.

Balance As to Seasonal Variations. Another feature of balanced production is that of keeping the men employed steadily and the factory running the entire year. It costs too much to let trained men go, only to spend a great deal of time and money in breaking in new men when production starts up again. The wise manager tries to eliminate seasonal peaks in production by filling in with nonseasonal products or products whose seasons come at different times.

The aim of efficient management is to keep the plant steadily busy up to capacity output the entire year.

A manufacturer of cameras and photographic supplies suffered from the fact that his business dropped off heavily from October to January. This seasonal fluctuation in output caused a large labor turnover. He investigated many additional products that could be made at his plant and decided that the most satisfactory line to add would be wooden Christmas toys. These could be manufactured with the use of some additional woodworking machines and special tools. This work kept 75 per cent of his labor

force busy until December. Then by giving attention to advance sales of his regular line of cameras and photographic supplies, he could safely switch back to the manufacture of this line as soon as his toy orders were all filled.

The manufacturer of a product whose market shows a marked peak in seasonal demand should plan for a more balanced production schedule, either by finding or developing new markets or by adding a line whose demand peak comes at a different season.

Balance As to Capacity. Unevenness in production may be ironed out by planning production under a master plan which considers the real plant capacity, the sales estimates, and also the financial requirements of different periods of the year.

Management must know its full potential plant capacity, and take steps that may be necessary to utilize all of it.

When full plant capacity is known, it is often possible to increase production from 25 to 50 per cent without any trouble whatsoever.

Sometimes a works manager says that his factory is working 75 per cent, or 50 per cent, or 90 per cent of capacity; but by "plant capacity" he may mean merely the condition when every man and every machine is busy. If so, he may not be thinking of *real* plant capacity.

Is every man continually busy? Is every machine going every minute of the working day? What are the possibilities of double-shift work? Answers to such questions may bring out the fact that the real plant capacity is far greater than it was supposed to be.

Full plant capacity means the maximum output attainable under truly efficient plant management.

A manufacturer of packing boxes recently installed a complete production-control system and also a bonus system. His output before the installation was 700,000

feet of lumber a month. Eight months after the introduction of these modern methods, his output, with exactly the same men and the same machines, was 1,200,000 feet. This meant not only reduced costs but also increased earnings for the workers.

Exceeding Normal Plant Capacity. While ordinarily it is unwise to force production beyond the full normal capacity of a plant, yet this is sometimes advisable, even tho it means a sharp increase in the cost per unit of output.

It is in some cases profitable to overload a plant thru a short busy season, even by overtime or double-shift work at comparatively high unit cost, if by so doing the sales department can increase its market to keep the plant busy at full normal capacity during the rest of the year.

The ideal condition is so to adjust all requirements as to make possible the operation of a plant at full normal capacity thruout the year.

Thus there are many important factors to be considered in planning production. They will be explained fully in Executive Manual 37, where we shall take up the subject of control thru planning. Enough of these factors have been suggested to show that it takes a man with foresight, broad-mindedness, leadership, and executive ability to solve the problems of plant management.

The works manager must know the principles of business management as a whole, as well as of plant management.

The executive who is trained in management principles sees in a well-balanced industry, and in the correct solution to the manufacturing problems, very definite evidences of the results of analysis, system, control, and of the functioning of administrative efforts.

Three Kinds of Production Problems. Analysis of production problems plainly reveals the fact that an execu-

tive must have had training in the general principles of management in order to handle successfully the important problems of industry. Analysis of production problems reveals two main groups:

1. Problems of production facilities.
2. Problems of production management.

In the first group may be put the problems which refer to—

1. Purchasing.
2. Employment.
3. The designing of the product.

These three kinds of problems are of a distinct nature and each kind is often handled by a separate department that functions as an aid to production management.

Problems of production management—the second group—cover all of the production details before and during actual manufacturing. There are three major divisions of the problems of production management, as follows:

1. Problems of organization and administration.
2. Problems of production engineering.
3. Problems of production control.

The solution to these problems is usually considered to be the duty of the industrial engineer or management engineer, who must be competent to direct the analyses and procedures in each of the above groups. The executives in all departments of the business must, however, have a clear appreciation of such problems, so as to insure real co-operation between all departments; also, because each department has production problems of its own and can solve them most efficiently when the executives understand production principles.

While departmental organizations differ widely, yet each must adopt definite uniform systems for the sake of uniformity in work and records. It is the function of

administration to supervise the organization as a whole as it carries out the systems.

This manual and Part I of the following manual will deal with the problems of organization and administration as they relate to production—how they are solved in order to tie in properly with the other factors of business administration, such as finance and marketing.

The second group of problems as above analyzed—those of production engineering—relate to such important matters as plant location, specifications, design of tools, plant layout, equipment, industrial research, and standardization.

The third group of problems—those of production control—relate to the preparation of production orders, requisitioning of materials, scheduling of work, planning, dispatching, and the rest of the functions which carry out complete production control.

A complete analysis of the three groups is presented in Figure 1 on the next page.

Organization Problems. A works manager or industrial engineer is faced by an organization problem just as complicated as that which confronts many a general manager.

The works manager must fit his men to the organization and must also fit the organization to the men.

The human element enters prominently into this problem. The expense of wages or salaries to the men must be such that the results secured are proportionate to the expenditures. Money is an important factor.

In the group of organization problems, we usually place the designing and installing of production systems and the writing of standardized procedures. Furthermore, we consider also in this group the designing of proper reports for the management and the supervising of the use of these reports to make sure that the statistics reflect the actual conditions of the industry.

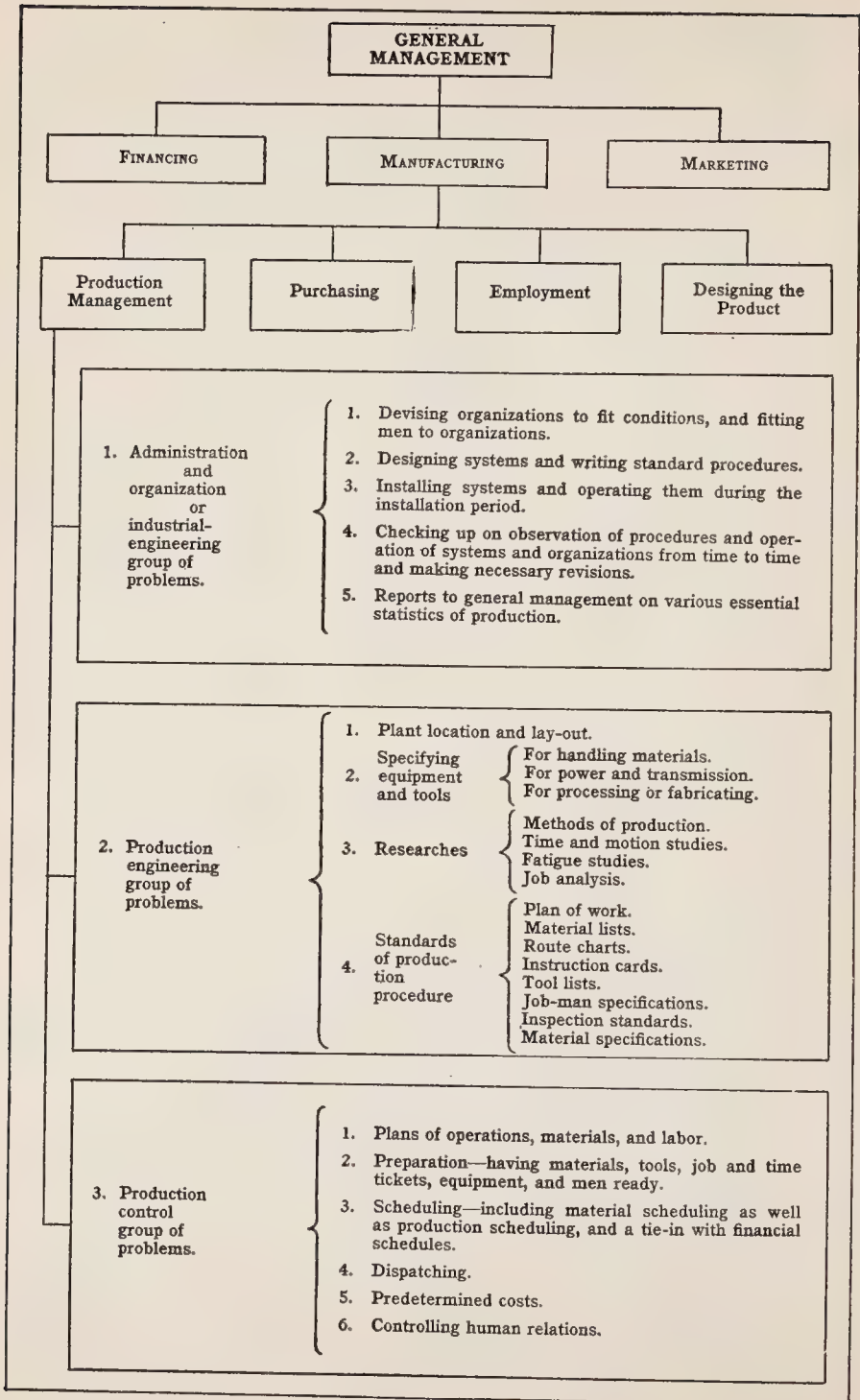


Figure 1

Last, but not least, the works manager uses organization charts to outline duties and responsibilities definitely and to determine the limits of authority, so as to eliminate, as far as possible, any overlapping of duties and any friction on account of misunderstandings. The preparation and use of organization charts will be taken up fully in Executive Manual 34.

Production Engineering Problems. This group includes the problems of plant location, equipment for all manufacturing processes and for handling the materials, power and transmission apparatus, and design and maintenance of tools, jigs, and fixtures.

These problems include the research work relating to the establishment of standards, such as time and motion studies, fatigue studies, and job analysis—and the resultant plan of work, material lists, instruction cards, tool lists, and job-man specifications; also the establishment of purchase and inspection standards and specifications. Manifestly—

Production engineering deals with machinery and methods, and, from a technical standpoint, with materials.

To a certain extent some of the studies in this group deal with men also, but primarily with men as skilled “machines,” leaving the important consideration of their feelings or emotions to be included in the next group of problems.

The Production-Control Problems. Production control embraces policies, systems, and procedures devised by management. Effective production control means systematic planning, preparing, scheduling, and dispatching of each job. It involves the balanced requisitioning, purchasing, and storing of materials. The financial element enters strongly, for here inventory values, expense analysis, and departmental budgets are also included.

Production control also deals with men, for it includes employment, training, incentives, rating and promotion, and industrial-relations activities in general. These activities may be directed by a personnel manager reporting direct to the general management instead of to the works manager. The man-control problem is, however, in every case, a problem of production control.

The development of the man-control problem is a very recent one. It has been emphasized by the need of increased man power and intensified production.

Not only improved manufacturing methods and labor-saving equipment but better working conditions result from widened knowledge of the principles of management.

It is not surprising that constant improvement, with more definite methods of attacking production problems, and with better information along the lines of industrial control, has caused "labor" itself to become more productive and more interested in its work.

In the beginning of this development, the management principles were thought to apply only to the large new industries which had carried the experiments in this field to success. But it has been found that the very existence of the smaller businesses depends upon their adopting, in principle, the same organization and policies as the large companies, and on their adapting modern management methods and systems to their needs.

These recent developments in industry will now be taken up in detail. Every executive should understand how widespread is this development and how it was accomplished.

MODERN DEVELOPMENTS OF INDUSTRY

Industry has undergone marked changes in recent years. A hundred years ago we had three people living on the farm for every one living in the city. To-day the

situation is practically reversed, due largely to the increased efficiency of farm machinery and farm methods.

One man on the farm to-day is producing more than nine men produced a century ago. One hundred years ago 4 per cent of our population were living in cities of 25,000 or more inhabitants. To-day 60 per cent of our population are living in such centers.

Business statisticians and economists have figured that, measured by quantity and not by dollars, we produced 33 per cent more manufactured goods per wage earner in 1925 than in 1914, for which the wage earner was paid 35 per cent more than in 1914, figured in "real wages"—in the purchasing power of the wages received. And these workers with their greatly increased purchasing power form a large part of the market which buys the goods which they help to make.

Industrial leaders in the United States have discovered during these post-War years that the soundest business expansion is based on paying high wages for efficient production and thus "creating" a larger market. The wage earner is now able to satisfy his desire for good clothes, a comfortable home, education, and pleasures. He buys so freely as to make constantly larger demands on the industries which supply his needs. A widespread appreciation of this great economic law is already causing changes in our social order termed by some a "silent revolution."

These changes are proving profitable to the management and owners of industrial plants as well as to the wage earners, for investigation of the comparative cost records of many industries shows a downward movement of costs about proportionate to the upward movement of the volume of production.

How These Developments Are Accomplished. How have these increases in production and reductions in costs been accomplished? Primarily thru machinery. The machin-

ery of to-day is more economical, more rapid, and more durable than the machinery of a few years ago; and to-day machinery is being placed far more scientifically as regards sequence of operation and uniformity of the flow of work, so as to secure travel in one direction without retracing of paths and with the right amount of room for worked materials and materials in process.

Not only the use of more machinery and of better machinery but also the better use of all machinery achieves increased production at lower cost per unit of output.

The handling of worked materials in process is receiving as much attention to-day as materials inside the stock room received a few years ago. This is evident in recording worked material and having proper places for its storage while in process; also in methods of conveying, trucking, and transporting. The manufacture of devices for handling materials has become a large and growing industry, and an increasing number of engineers are specializing in this field.

Increases in production and lower costs have resulted, not only from improvements in machinery, methods, and organization, but also from equally important improvements in handling the human problem of industry. We no longer select men in a haphazard way. We analyze and classify every occupation and job and determine definitely what human qualifications are necessary for each class and grade of work. We then develop measurement standards for determining whether or not people possess the required qualifications for their job. This phase of modern personnel management is applied, not only to the handicrafts and trades, but also to the selection of foremen and executives, and methods of training are employed whereby foremen and executives are developed to higher standards of efficiency.

MANAGEMENT TERMINOLOGY

Before proceeding further it may be well to reach a common understanding of the meaning of certain terms which we will use frequently. If certain terms have but vague meanings to us, our thoughts on these subjects will be vague. If we use words in an incorrect sense, not only are our own thoughts likely to be confused, but our hearers will probably not get our meaning.

A study of any problem of business or of anything else should include a clear understanding of the accepted meaning of all the terms used.

Business and industrial management, as they have developed into sciences, have adopted certain words and use them in a technical sense, which sometimes differs from the popular sense. It is, therefore, necessary to become familiar with the technical meaning of certain terms used in industrial management, meanings used by men who are the leaders in the profession. You can see the need of studying carefully the meaning of the technical terms used in this and the following manuals on production. The meanings given to these terms are the most generally accepted expressions of correct present-day usage among authorities on industrial management.

There is a tendency among men who have made a mistake in the employment of terms to say, "Well, we use that word here to mean something else." The danger of insistence on a different meaning from the generally accepted one is that it will confuse hearers, new employes, and other members of the organization.

Let us here define, in detail, two terms which are frequently used rather loosely, namely, "system" and "efficiency."

The Meaning of "System." The term system is applied to the methods by which the activities of the organization are carried out in an orderly way.

The characteristics of system are simplicity and efficiency. System helps to shorten the time between receipt of an order and its delivery and payment for it. When these characteristics are lacking, we find "red tape," not system.

Having planned an organization and determined on the activities and interrelations of the various individuals, we then prepare a series of ways and means for securing results as planned. These ways and means, when arranged according to a logical, scientific, and orderly plan, constitute system.

A man may be a systematizer, however, and yet not be a successful organizer, or even an efficient manager.

The man who aspires to rise higher than a systematizer must make system his servant and be very watchful lest the situation be reversed and he become system's slave.

The Meaning of "Efficiency." By efficiency we mean the ratio of output to intake. For example, an electric motor of 85 per cent efficiency gives out only 85 per cent of the horsepower value of the electricity delivered to it.

In speaking of the efficiency of a cost system or a production system, we compare the net useful worth of the results secured thru using the cost system with the total cost of operating the system, including salaries of clerical and administrative employes, cost of stationery, and first cost and depreciation in the value of furniture, fixtures, and mechanical appliances required to carry out the system.

Principles v. Methods. A system devised for a specific industry and organization can rarely be applied, in exactly the same form, to another industry or to a different type of organization in the same industry.

It is the sure sign of an amateur to be a "form collector" and to spend more time in devising the details of card indexes, loose-leaf files, and storage cabinets than

in studying and mastering principles. On the other hand, it is equally the earmark of ignorance to brand all principles of organization and all orderly methods as "red tape."

Some devisers of mere forms and systems call themselves "efficiency engineers"; but our definitions show that this work is only a minor factor in production management.

In general, it may be said that it does not make such a great deal of difference how the words "system" or "efficiency" are used so long as methods are not confused with principles.

A company which is up to date and anxious to install modern methods must first consider principles; it must not begin with certain "pet" systems, no matter how well recommended such a "pet" system or scheme may come from some other industry.

As has been pointed out above, a successful system in one industry or business may fail utterly when employed by some other industry or business where conditions are different.

It is important to bear in mind that to apply the principles of profitable production, an executive must know more than systems and efficiency. He must catch or understand the mental attitude and the spirit of the entire personnel. He must win the loyalty and co-operation of all of the department heads and the rest of the employes. How to do this is fully treated later on when we come to our detailed treatment of the problem of managing men.

THREE BROAD CLASSES OF MANAGEMENT

It is generally considered that there are three broad classes of management, as follows:

1. **Old-Fashioned Management**—the kind which does not believe in modern developments and which prefers to drift along in a hit-or-miss way, relying upon guess-

work or personal judgment for its progress. It is generally made up of men who trust to their personal experience, and of executives who do things in a certain way because their fathers used to do them that way.

2. Systematized Management—the kind of management which is a “stickler” for system and efficiency thruout, favors any and all systems, tries out the schemes of nearly every efficiency man who comes along, installs elaborate reports and records without co-ordination, and believes in “cut and dried” rules that almost make “machines out of the men.”

3. Scientific Management—the modern plan of management that first investigates what has been used in other industries and then studies the application of the management principles to its own particular case. This is the kind of management that is composed of broad-minded individuals who are leaders, not drivers; who can get results under all circumstances; who can cut costs without slashing the pay roll; and who can introduce working conditions that create good will among the workers, as well as satisfy the management.

It is this third kind of management in which we are now interested and which will be taken up in the second part of this manual.

PROBLEMS OF PLANT MANAGEMENT

Part II

INDUSTRIAL MANAGEMENT A SCIENCE

MANY engineering problems in production management are so clean-cut and scientific in nature that the obvious way of attacking and solving them is to use the methods which are customarily employed in scientific research. Only in recent years, however, have scientific methods been used, not only in production engineering, but in the broader problems of organization and administration as well.

Scientific method means that, before action is taken, an investigation is made of every aspect of the subject involved.

This investigation includes not only the methods and conditions in our own business but also a survey of methods used by others, their results, and a study of the differences in conditions as compared with our own conditions. We are then in position to adopt the standards which best meet our own conditions.

What Is the Science of Management? The use of the expression "scientific management" assumes that there is such a thing as a science of management. The briefest and most commonly accepted definition of science is "knowledge carefully digested and rationally arranged."

We may define the science of management, then, as all the available knowledge of the physical, mechanical, and psychological conditions, methods, processes, relations, and results in the field of management. This knowledge must be accurately obtained and carefully digested to reveal laws and principles; it must be rationally arranged and systematized.

The foregoing definition of the science of management covers all management, whether it be manufacturing or

distribution, municipal government or national government, the army or the navy, educational institutions, or any other field of management.

The Meaning of Scientific Management. Scientific management is management in accordance with the principles and laws derived as outlined. It includes, therefore, the selection of men and methods, and the proper training of the men in the methods.

The narrow interpretation of the term "scientific management" conceives it to be the collection of the visible, tangible paraphernalia used by one or another expert or group of experts in applying so-called "efficiency methods" to some particular industry or activity.

The fact that Frederick W. Taylor was the first man to advocate the use of scientific methods in management has often served to confuse the minds of industrial executives, and to lead them to believe that the Taylor "system," which is a rigid code of procedure that Taylor used in his own practice, is synonymous with management science. Such is not the case.

The science of management is the formulation of principles; whereas scientific management is the application of specific principles in solving specific problems of management.

Taylor, it is true, announced certain fundamental principles of management science, but when we talk to-day of the science of management we do not mean the Taylor system nor any other so-called "system"; we mean, rather, the development, as a result of our investigation, of a certain group of fundamental principles and a code of basic policies adapted to the particular undertaking in hand.

Because Taylor used stop-watch time studies and Gilbreth used the motion-picture camera in discovering and preventing fatigue and time-wasting methods, many people erroneously visualize scientific management as a program in which the stop watch and the motion picture

play a prominent part. These are useful devices, but a perusal of Taylor's *Art of Cutting Metals*, in which he explains all the variable elements involved in metal cutting, a study which revolutionized the machine-tool industry, reveals the fact that stop-watch time studies play only a minor, tho important, part in scientific management.

The Range of Applied Scientific Management. The wide range of problems that are handled on the basis of scientific methods has already been suggested in Executive Manual 6, where we had a preliminary view of the problems of production. There we listed among the basic problems in attaining low-cost production such matters as plant location, working conditions, planning, shop layout, use of purchased parts, and purchasing methods and principles. Each of the decisions we reached as we studied Executive Manual 6 was based on a principle which served to direct us in applying scientific methods to the problems there considered.

These scientific methods will now be explained in greater detail. We shall avoid possible confusion of thought, due to what we may have read or heard about the "systems" of some of the men who first proposed scientific management, if we first consider the objectives and ideals of the individuals and companies who have consciously applied scientific management in the solution of industrial problems. Later on, the methods they used will be illustrated, and how those methods have been developed to fit present business needs and conditions will be shown.

Motives in Applying Scientific Management. As already explained, a science classifies knowledge, and thereby makes it more available for use.

The science of management, like the science of chemistry, is a valuable tool and can be made to serve the good of the many.

A science may be used harmfully. But a science cannot be held responsible for any improper motives on the part of those who use it as a tool. The science of chemistry has been made use of by counterfeiters, and no doubt an unprincipled manager could utilize the science of management to the disadvantage of his employes and the public, altho in the long run his purpose would probably be defeated.

Unprincipled uses to which the data and methods of all sciences have at times been put are here mentioned, since such uses have been brought forward by some who therefore condemn scientific management. But the objectors to scientific management fail to realize that the information and data disclosed by practically every science are subject to unprincipled and destructive uses. Shall we condemn psychology because the clairvoyant makes use of it?

If we were to define the science of explosives, we should not attempt to discuss in our definition whether the explosives were to be used for digging postholes, removing stumps, or waging warfare. If we were to define the science of organic chemistry, we should not enter into a discussion of the merits or demerits of food adulteration.

Of scientific management, as thus far applied in American manufacturing establishments, it can safely be said that the motives of the proprietors of the industrial establishments in which scientific management has been fully developed have been eminently fair toward employe and consumer.

The Holt Manufacturing Company, of Peoria, Ill.; the Joseph & Feiss Co. (the Clothcraft Shops), of Cleveland, Ohio; and the Franklin Motor Car Company, of Syracuse, N. Y., are examples of the many shops in which scientific management has been applied in a manner which reflects most favorably on those responsible for the application.

Dr. Taylor clearly stated again and again that his aim was the attainment of a lower cost of production coupled with higher wages. These results have been obtained in the shops cited thru the conscious and planned application of the science of management.

In general, it may be said that—

The aims of the leaders in the field of scientific management are the attainment of the most efficient conditions, methods, processes, and relations, with due regard to the interests of the owners of the business, the employes, the customers, and the community at large.

The term "efficient," as used here, has both a broad and a narrow interpretation. Efficiency, broadly interpreted, is the same as the principle of conservation of resources and energy in its most general application. Efficiency in this sense means the minimum of waste, not only of the material and capital of the proprietor, but also of human health, energy, and happiness; and it means the minimum of waste of the nation's natural resources as well as the development of the greatest general prosperity among the community at large.

HOW TO APPLY THE SCIENCE OF MANAGEMENT

We now have a clear idea of the broad scope of the science of management and of the aims which the leaders in this field have found to be permanently profitable and practical. Next, we want to see how this science can be applied to improve working conditions in factories, stores, banks, railroads, and offices; to increase the output of all machines, from the automatic screw machine to the wheelbarrow; to assure standard quality of all products, services, and utilities, as well as reliable clothing, well-cooked restaurant meals, and dependable street car service; to make the pay checks larger for laborers, clerks, specialists, department heads, and managers; to substitute fellowship for friction in the relations of man-

agement and men; and to increase profits and put bigger dividends into the pockets of the owners of business.

Establishing Clear-Cut Objectives. In Executive Manual 1 and elsewhere in this plan of training, the importance of scientific procedure in solving business problems has been emphasized.

It is essential that every executive, and every worker who wants to be an executive, thoroly understands both what is meant by scientific procedure and how to follow it.

Here in our study of production principles we have our best opportunity to become thoroly acquainted with scientific procedure.

The very first step to take in solving any problem is to get a clear and fully detailed view of the definite objective, or goal, to be attained.

Just what does the business in which you are interested seek to accomplish? Just what is the science of management to accomplish in it?

More profits is almost always a part of the answer, but profits can be sought thru so many channels that this answer is indefinite. An example of a definite objective is to set a goal of selling, say, 1,000 washing machines a year, or 5,000 sewing machines, or 10,000 typewriters.

Suppose you were to ask the president of the Paper Products Manufacturing Company, whose policies you studied in Executive Problem 3, what the purpose of his business was—what the objective was in managing it.

One answer might be, "To build up a profitable enterprise thru supplying large numbers of consumers with paper goods of good quality." Pressed for a more complete statement of his objectives toward which the entire management of the business was striving, he would probably analyze his objectives somewhat as follows:

"A steadily growing business of whose reputation for fair dealing and good quality we can be proud. A con-

tinuously profitable business which will pay its investors consistent and substantial returns. A sales and manufacturing policy which assures permanent employment of, and efficient co-operation from, the workers, encouraging long-time service. Fairly sharing the company's prosperity with its men. A policy of management which offers greater opportunities and rewards to men who prove worthy. An effective plan of training the men for better positions."

Such a detailed set-up of objectives serves as a guide to improvements of many kinds. They are the part-way objectives mentioned in Executive Manual 1. Setting them up definitely and in detail is the first step in scientific management.

One of the great contributions that the modern study of scientific management has made to all phases of business management is the stress it lays on the principle that—

Every business and every department in a business should set up its clearly defined objectives.

These objectives should be carefully worked out and clearly stated in writing; and they should be reviewed from time to time to make sure that they are still adequate.

Objectives Should Be Definite. A sales department will work harder to reach a goal of "\$1,000,000 in sales this year!" than for "All the business you can get." A rolling-mill crew will work harder to beat a rival crew's tonnage record than for "We're busy, men! Get out as much as you can."

How it is that the use of a definite and concrete goal impels action to gain that goal more strongly than in the case of indefinite or abstract goals was fully explained in the manuals on psychology. Scientific management makes use of this psychological principle.

In establishing a goal of attainment for ourselves, our department, or for the business as a whole, let us remember to make that goal definite and specific and concrete. Let us set down in black and white just what we propose to accomplish. This clears the deck for action. It is an essential first step in approaching any problem.

The Need of a Preliminary Survey. A preliminary survey of facts and conditions in connection with any activities to be organized is necessary in order to determine just what we want to accomplish in the way of objectives.

A clear picture of the result wanted is the first step in organization as well as in performing every other kind of work.

An officer in charge of all army work at a large cartridge company desired to familiarize the officers of his staff with all the steps in connection with cartridge manufacture, and at the same time to make a preliminary survey of the work. This survey included:

1. A description of all materials used; the sources of supply; the physical, chemical, or metallurgical composition; the usual quantity ordered and carried in stock; and the amount needed per million cartridges.
2. The steps in manufacturing cartridges, including photographs of machines and tools, photographs and samples of the product as it underwent each step, a list of all possible defects, methods of gauging or testing to discover defects, and the reduction in weight of material and quantity of scrap produced at every operation.

This preliminary survey became the basis for remarkably increased production thru the substitution of modern material-handling devices, such as gravity and belt conveyors, in place of the old hand trucks and barrels which were causing congestion and confusion. It afforded also a basis for developing an inspection system in which inspection of parts in process was employed to supplement inspection of the finished product, and thus save time and expense by making sure that the various parts were perfect before they were assembled into the

finished product. The preliminary survey also uncovered many weak spots in production control, which enabled this army officer to start his work with very definite objectives.

Securing Facts for Setting Standards. Only when we know definitely what we propose to accomplish are we ready to secure authoritative facts from which to decide upon the best quality of materials; the most efficient machines, methods, and workmen; the employes' pay and working conditions, etc. Many of these facts come from past records of experience, both our own experience and the experience of others. Also, many facts must be secured by careful scientific study of the work to be done thru time, motion, and fatigue studies, and job analyses.

This latter source of facts for setting standards is so important that it is fully discussed in subsequent manuals, which deal with research work, the analysis of the data secured, and the standardization which is usually possible.

The Means for Applying Standards. In applying the standards established by analysis of the facts, we get into questions of organization, of planning, of control, and of equipment.

Perhaps we may wish to regroup existing departments and to place at the head of a functionalized controlling system the men who are best adapted for carrying out the plans.

Functionalized control means that specialists, working under a high official, such as the general manager or works manager, are given authority to go into any department to supervise and control that field of work in which they are expert.

Under functionalized control, the specialist in charge of adjusting and maintaining the machinery, for example, has authority to do this thruout the entire plant. In an office which is under functionalized control, one man may

have charge of employe records, promotions, salary changes, and the like for all departments. Another may supervise general health conditions and the personal health of the employes in all departments.

In a large organization there can be fine divisions of functionalized control in both plant and office. In the smaller businesses, less of this responsibility can be delegated by the general executives. The relation of functionalization and specialization to organization will be fully explained and illustrated in Executive Manual 34, where we shall take up in detail the subject of organizing for control.

Seeing that Standards Are Utilized. Next it is essential to see that the standards set up are utilized. This means that there must be an adequate training and demonstrating force to work with those who are to apply the standards in order to put them into successful use thruout the plant.

To set up standards to be followed is one problem;
to put those standards into use is another problem.

In some organizations this training and demonstrating has to be done by the foremen. But whether this duty falls to the foremen or to a specially organized group of trainers, the teaching and demonstrating must be capable, enthusiastic, and tactful. In addition, a decided incentive for success in meeting the standards must be offered to the workers.

These important matters of plant management also will be fully treated in later manuals.

Continuous Investigations. Certain investigators may be kept continuously at work devising improved methods and effecting economies. These investigators may include not only members of the staff but also men in the ranks competing for rewards thru a well-organized suggestion system.

Progressive business management provides for continuous investigations designed to uncover ways and means of improvement in all departments.

Many companies not only provide for continuous investigations aimed to find out how to lower producing costs but also have special departments for sales research which aim at discovering practical means of improvement. In the accounting and administrative departments, also, the search for better methods is often systematically and constantly carried on.

The very rapid improvement in industrial methods and equipment makes it necessary for production managers to take a lively interest in all kinds of possible improvements, lest some competitor reduce costs and prices to a point which cannot be readily followed. When one company successfully introduces a way in which costs may be lowered, others in the same field have to make equivalent economies or fall behind in the race.

The Duties of Management. In applying scientific management to any enterprise, management must take on certain additional duties. Sometimes it is harder to get the management to take a new point of view and to take up these additional responsibilities than it is to gain the co-operation of the men.

The management must keep permanent records of costs and of results in applying standards, and must be responsible for control over what, when, where, and how everything is done.

A Government committee appointed to investigate waste in industry charged management with being directly responsible for over 50 per cent of this waste. The committee investigated hundreds of industrial establishments and attributed management's responsibility to faulty control or lack of control of design, materials, production, costs, labor, and sales; to lack of research; and to ineffective workmanship thru failure on the part

of management to provide opportunities for the training of workers.

Efficient management fully recognizes its own responsibility for wastes in the business it controls.

Management is also responsible for seeing that the workers' interests are safeguarded and that the new system of management means also a new spirit of loyalty and co-operation thruout the business.

How management discharges this responsibility will be fully covered in these manuals on the principles of production.

The Application of Scientific Management Involves—

1. A preliminary survey and the definition and analysis of our purpose.
2. Securing the necessary data.
3. Establishing of standards.
4. Applying the data and standards.
5. Seeing that the data and standards are used.
6. Providing for further investigation to secure new knowledge.
7. The assumption by the management of all duties for which it is best fitted; the operators to have only such responsibility as is justified by the nature of the work.
8. A due regard for the rights of owners, management, employers, customers, and the public.

The Rights of All Must Be Considered. Let us now briefly consider another very important principle of efficient management that applies in every business organization. It is a very simple principle of management, but we should not let its simplicity conceal its importance.

Efficient management gives fair and impartial consideration to the rights of all parties concerned.

That is the principle, and it requires that—

1. The owners shall receive the largest profits which can reasonably be expected, giving due consideration to the interests of employes and consumers.
2. The employes must receive not only the highest prevailing wage accorded to their various crafts but also the aid of efficient organization and system to encourage and, in fact, to compel high standards of performance.
3. Consumers must be given a share in the benefits of improved methods by a price that gives them more for their money.

Thus there are three classes of people whose rights are to be considered by the management of every business enterprise. To a certain extent the interests of owners, employes, and consumers conflict with each other. But to be partial to one or the other of these three classes of interested parties, to neglect the rights of any one of these classes, is to risk incurring serious resistance to the successful development of the business. Investors can withdraw financial support, employes can become disloyal, and consumers can withdraw their patronage. Applying the principle of observing the rights of all concerned is the means of avoiding these risks.

Taylor's Principles of Scientific Management. Let us now analyze the practical steps to take in applying scientific management by briefly considering certain principles of scientific management as laid down by Frederick W. Taylor.

The chief aim of scientific management, as formulated by Taylor, is the lowering of costs of production, coupled with higher pay for labor. He stated that this aim is to be attained thru—

1. The working up for every activity or industry of a science to replace the traditional or rule-of-thumb knowledge possessed by all connected with the activity.
2. Planning processes and operation in detail by a special division organized for this purpose.
3. The scientific study of the workers—finding out the human characteristics required for every class of work in the

- given activity, selecting the workers in accordance with the resulting specifications, and training them in the most efficient methods.
4. Organization, in which a single line of control is exercised by each functional division.
 5. The assumption by the management of its due share in the foregoing steps and not leaving these matters to operators or line officers.
 6. Equitable payment of the workers based on quantity and quality of individual output.

It is thru the recognition and use of the above principles that the most effective types of organization and management have been developed. Later on we shall get well acquainted with the meaning and application of those principles. Here at this point, let us note a few specific cases where these principles have been applied and the results attained.

Where These Principles Have Been Applied. Management has been quick to see ways in which the principles of scientific management may be applied in distribution as well as in production.

A national chain of drug stores has applied principles of scientific management in studying its inventories and its store arrangements. As one result, the number of different articles carried in stock was cut from over 40,000 to less than 10,000; and the stock turnover was increased many fold. It was found possible to serve many more customers without increasing the size of its stores.

A certain manufacturer was one of five competitors, all of whom were making practically the same type of article. Competition was so keen that growth seemed impossible, until the sales-research department applied the principles of scientific management in developing marketing and sales methods. The resulting plans reduced the cost of distribution and opened up new markets. A 50 per cent gain in sales was reached in two years.

A sales manager in the plumbing-supply line doubled the sales on certain very profitable items of the line by applying the principles of scientific management to the selection of the right incentives for the sales force. These incentives were explained in Executive Manual 22.

A large supply house reduced its inventory by \$87,000 and at the same time reduced delayed orders to zero thru the use of these principles. Also, some "by-product" gains were found which more than equaled the direct gains that they had set out to find.

In the field of manufacturing, a pulp and paper manufacturer worked out and used manufacturing and management methods based on these principles, and thereby increased the output of his plant from 42,000 to 111,000 tons a year without adding any equipment or changing the character of the products.

A box manufacturer reports that after these principles were skillfully applied in his business, wages per man were increased 22 per cent and output was increased 50 per cent.

A hardware manufacturer found that scientific management for him meant an increase in output of 300 per cent, while his men rejoiced in an average increase in wages of 33 per cent.

This list could be extended to include examples from almost every industry and line of business. Many additional instances of the application of these principles will appear in the later manuals.

* * * * *

In Executive Manual 34, we shall take up a somewhat detailed study of one of the most fundamental problems in the science of management—that of organization. Relatively few men have a thoro grasp of the principles of organizing for effective control. Understanding these principles and knowing how to apply them will, as much

as anything else in the science of management, enable you to "stand out" among business men.

First, however, let us get a better grasp of the principles presented in preceding pages by using the check-up that follows, and by working out Executive Problem 33, which shows how the principles presented in this manual may be applied and which will give you confidence in your ability to apply them.

CHECK-UP ON PRINCIPLES

Use the following check-up to get the principles of this manual firmly fixed in mind. This will help you to handle the problem which follows. This check-up is entirely for your own personal use, so you need not send it in to the University.

	Check	
	Yes	No
1. A busy housewife purchased a vacuum cleaner so that she may more easily clean her rugs. Does the production problem she thus solves include the seven M's—management, materials, machinery, methods, men, money, markets?		
2. A manufacturer of rubber goods specialized on two lines. On one competition was keen and the margin of profit low. The other sold in equal volume at a better profit. The manufacturer gave most of his attention to ways and means of lowering his cost on the first line. Is it likely that this time could have been spent more profitably on the other line?		
3. An ice-cream manufacturer refused to take on more customers than he could take care of with his plant running ten hours a day. This meant during the winter too little work to keep the plant busy. Does such a condition make two-shift work in summer advisable?		
4. Is it possible for a period of a few weeks to get out maximum output even tho working conditions are somewhat unfavorable?		
5. Is it possible continuously for a year to get a maximum output under any but very favorable working conditions?		
6. Does the fact that one car owner will use one-fourth less gas than another in traveling the same road at the same average speed in identical automobiles illustrate an important production principle?		
7. Is it condemning an executive to say, truthfully, that he is a slave to system?		
8. Can the investigator who approaches his problems with definite and positive opinions regarding the situation work as accurately and efficiently as an open-minded investigator?		

	Check	
	Yes	No
9. Is it possible for a company to use the methods of scientific management to gain permanent maximum efficiency if it disregards the interests of the workers?		
10. Are permanent maximum profits possible if the general public is not given a share in the savings?		
11. The owner of a chain of meat markets equipped each market with computing scales. When complaints continued to come in that prices were figured wrong, he found that his men were not using the computing feature of the scales. Is this surprising?		
12. A ladies' wear manufacturing plant has just been systematized on scientific lines. The president is in sympathy with the work, but has found it hard to adjust himself to the new point of view; he now remarks with a huge relief, "Well, the system is in now, so we can forget it and turn our attention to sales." Is he overlooking two vital factors in scientific management?		
13. Have you written out the detailed objective toward which your firm seems to be driving?		
14. Have you written out the objective which you aim to reach within the next twelve months?		

Executive Problem 33

KEEPING THE SHOP BUSY

Balancing Seasonal Variations in Production UNDER THE LASALLE PROBLEM METHOD



MANY businesses have “seasons” when demand is light. Yet the most profitable production depends upon a shop being busy the year round. You will in this problem learn how sales principles, production principles, and financial principles are all needed to solve the problem of seasonal variations in demand.



Prepared by the Research and Consultation Staff of LaSalle Extension University from an interesting problem which it has carefully investigated and analyzed.

Executive Problem 33

KEEPING THE SHOP BUSY

You have learned a very important principle in this manual:

**Every production problem includes the seven M's—
management, materials, machinery, methods, men,
money, and markets.**

Its importance is largely due to the fact that every business problem—not production problems alone—includes these same seven M's. They are needed in selling, in transportation, in financing. Stop and think this over for a minute. Sometimes the only machinery involved is an order book and sometimes only a typewriter. Sometimes materials are most important and sometimes men. But always all seven M's must be considered *in their relative importance* in solving every production and business problem.

This first problem of the production group is primarily based on the requirements of the business as to men and money. The company and the men want more steady work and employment; the company wants more profits. Yet in solving this production problem, you will find that all seven M's must be considered, including the principles of marketing which you completed in previous manuals, and which in this instance, as in many, are as important as the principles of production.

A STATEMENT OF THE FACTS

The Adams Company, Inc., manufactures a line of small tools for the garden and farm. Its plant consists of a small iron and brass foundry, a forge shop, a machine shop, an assembly department, and offices for the sales and administrative organizations.

Its products find a ready sale, for their reputation is excellent. The business is essentially seasonal, however, since the users of small farm and garden tools buy almost entirely during the spring and early summer.

The Adams line is distributed thru the wholesale trade to retail hardware and general stores, which begin to stock up in January. Shipments from the factory to the jobbers reach their peak in February, March, and April, and fall off rapidly during the summer.

Manufacturing begins in September and capacity production is reached in the late fall. This continues until April or May, depending upon the lateness of the spring. The summer months see the factory virtually shut down; most of the workers are laid off and only a skeleton organization is retained.

The managers of the firm have in past years considered this seasonal fluctuation a necessary evil. To correct it they have extended sales activities into the South and far North to take advantage of the early and late springs. Recently, however, stiffer competition, a better understanding of real manufacturing costs, and the increasing difficulty of obtaining skilled workers during the winter months have combined to convince the managers that something must be done to keep the factory busy the year round.

The president has discussed this problem many times with the sales manager and the chief engineer, who, with him, are the active owners of the business. The president thinks it will be best to enlarge the present line by adding a number of larger farm implements, such as cultivators, plows, discs, and harrows.

The sales manager, however, believes that some product outside of the present line should be developed—a product whose manufacturing and sales periods would coincide with the company's present slack interval. He suggests a flexible steering sled, which could be manufactured during the summer months and marketed during the fall and winter.

The chief engineer views the problem chiefly from a production standpoint, and he favors that they contract to make small automobile equipment, for which there is a constant demand. He suggests tire pumps, centrifugal water pumps, and gear oil pumps.

Each of these proposals is feasible. The president has asked an industrial engineer to make a thoro investigation of the merits of each and to recommend what should be done. This investigation has brought out the following facts:

DESIGN OF PRODUCT (MATERIALS AND METHODS)

Farm Implements: To add this line means the preparation of new designs, drawings, manufacturing instructions, etc. This will

not cost much, however, since the present drafting department can do the work; and the company's engineers are familiar with implements of this type.

Steering Sled: A flexible steering sled has been designed by the chief engineer from suggestions made by the sales manager and has been thoroly tested. The design has proved practical and has been patented. The sled is the only one of its type on the market. Very little expense will be involved in preparing the necessary drawings and manufacturing information.

Automobile Equipment: These articles will be manufactured according to specifications furnished by automobile manufacturers, so there will be no expense for design except for the preparation of drawings and manufacturing information.

The raw materials required for all these products are similar to those used in making the present line, and are readily obtained.

EQUIPMENT (MACHINERY)

Farm Implements: Considerable additions will have to be made to the existing equipment and tools. This will involve an expenditure of approximately \$140,000. There is room in the present buildings for installing the necessary additional equipment without interfering in any way with the production of the present line.

Steering Sled: This sled can be manufactured with existing equipment. There will be only a slight expense for new tools.

Automobile Equipment: For most of the work the existing plant equipment can be used. However, the specifications call for japaning and nickel plating, and it will be necessary to have this work done outside, or add equipment to do this.

METHODS

Farm Implements: The new products will not differ radically from the company's present line, so no great changes in manufacturing methods are involved.

Steering Sled: The design is simple and only one style will be made, which can be manufactured with the present equipment. This shows that new methods will not be especially hard to work out and place in operation.

Automobile Equipment: The development of effective manufacturing methods will not be difficult, as the proposed products are somewhat similar to some in the present line. However, volume production will require a closer control than is being kept over the present line.

PLANT ORGANIZATION (MANAGEMENT)

Farm Implements: The manufacturing of these implements will not require any new departments. Several more subforemen will be needed, however.

Steering Sled: The addition of this line requires a sheet-metal department (a new department) and one new section in the assembly department. However, one of the assistant foremen and several of the subforemen have had experience in sheet-metal work, so that this will not create a difficult organization problem.

Automobile Equipment: The manufacture of automobile equipment will call for several new departments and assembly sections. Experienced men can be obtained to get this work started effectively, however, so that this problem is not serious.

MEN

In the main, the same workmen can make these products as the regular line. Expert platers and finishers, however, will be required for the auto equipment unless the finishing is done outside.

DISTRIBUTION (MARKETS)

Farm Implements: Some of the jobbers and dealers who handle the present line will handle the farm implement line also. Some, however, have contracts with other farm-implement manufacturers, and others do not sell farm implements. To gain even fair distribution, therefore, agencies and local warehouses must be established.

Steering Sled: The sales manager has sounded out the market and feels that there will be a good demand for a sled of such novel design, and constructed of high-grade materials.

It will be sold partly thru the wholesale and retail hardware trade, but the sales manager expects to get most of his business from city department stores, mail order houses, and general stores which handle holiday goods. This product has a wide market, but to get a good volume of business the company will have to advertise nationally to acquaint the buying public with the sled's merit.

Moreover, since the product is so different from the present line, specially trained salesmen will have to be employed, and other changes will have to be made in the company's general sales plan. But the sales manager is confident that no serious difficulty is presented which cannot be easily overcome.

Automobile Equipment: There is no immediate distribution problem as the work will be done on contract. However, there is a question in the president's mind whether it will be easy to obtain future contracts. There are other manufacturers who can do **this**

type of work, and they may at times bid for it on a basis of cost, or even less than cost, to keep their equipment and personnel busy the year round.

Both the farm-implement line and the sled line can be sold and advertised as being made by the same company as the garden-tool line and will, therefore, add to the prestige of the present line. The automobile-equipment line, on the other hand, will not assist in selling the present line.

FINANCING (MONEY)

Farm Implements: The financing of new equipment amounting to \$140,000 must be considered.

The manufacture of the farm implements during the summer will make it necessary to store these implements from six to eight months before they can be sold. This will tie up much capital in inventories.

While the farmer usually purchases implements in the spring and early summer, he does not, as a rule, have the cash to pay for them until he receives money from sale of his crops. This means that dealers and agents expect rather long credit. In view of these facts, it is scarcely probable that more than one turnover a year can be secured on capital tied up in this line.

Steering Sled: The educational campaign of national advertising and personal calls on the retail merchants will involve large appropriations, probably \$75,000 a year. However, the cost of manufacture is moderate and the sled can be sold on a good margin of profit, so the profits will be large if the plans for distribution succeed.

From a financial standpoint, additional advantages are: quick turnover, short manufacturing periods, no additional investment in equipment, small capital tied up in materials in process and finished product, and small credit losses.

Automobile Equipment: This line will require very little financing. The manufacturing period of this equipment will in part overlap that of the present line, it is true, and this will tie up some capital in inventories, since goods must be made up ahead, to deliver while the plant is working to capacity on the garden-tool line.

Furthermore, the margin of profit is small. Until the company is reasonably certain that these contracts will be renewed from year to year, it will hardly be justified in spending the money necessary to equip a japanning and plating department. Yet if this japanning and plating work is done outside, its cost, plus the cost of shipping the parts out and in, will leave a very meager profit. Shipping the parts out and in may also cause delays and losses of various kinds.

Assume now that you are the industrial engineer to whom the president has referred his problem for advice. The work sheet which accompanies the problem will show you what steps to take in order to make a sound recommendation to the Adams Company, steps which mean that you will—

1. Observe closely and concentrate on the facts as presented.
2. Analyze carefully.
3. Organize logically.
4. Appraise accurately.
5. Decide judiciously.
6. Report intelligently.

BUSINESS MANAGEMENT

ORGANIZING FOR CON- TROL—Being Executive Manual 34, on Principles of Production, in a Complete Plan of Training and Service for Execu- tive Work

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ORGANIZING FOR CONTROL

Part I

ORGANIZATION ANALYZED

SUPPOSE you hire a hundred men to dig a large ditch and you turn them loose on the job without instructions. How effectively would they work?

Give each man a section of the ditch to dig and leave him to his own devices. That would put some system into the work; there would be less confusion.

Pick one man to boss the job; pick another to act as timekeeper; pick a third person as waterboy; divide the rest of the men into groups; place one man in charge of each group—and then you have the hundred men organized. They will dig more ditch per day.

Efficient organization serves to avoid confusion and to increase the output per man per hour or day.

What Organization Means. In a going organization, each man has definite duties which he is fitted to perform, and which are so related to the duties of his fellow workers that they can all work together as a team, pulling with and not against each other.

Organization primarily means determining the activity of each individual and group employed, and establishing their relations and connections with one another for a definite accomplishment.

Efficient organization means that the experience, technical skill, tact, and other abilities of carefully selected men are directed in such a manner as to be most effective in the interests of the business.

To be effective, an organization must be planned and built up to accomplish a definite purpose. Organizations differ in size and character according to the different pur-

poses for which they are designed. There are also differences in organizations designed for the same purpose. Some are more efficient than others in fulfilling that purpose. We want to know why and how this is true in order to develop organizing ability.

Here at the beginning of our analysis of the organization problem, let us remember that—

Organization is, broadly, a joining together of the necessary forces of men, materials, money, etc., to accomplish a definite purpose.

The human element is always involved in organization problems. Suppose you are organizing to control the storing of, and accounting for, materials. The main factor would be the way in which the workers will use the materials. In organizing for increased production, the major part of the work concerns men—selecting, training, and placing them best to serve the purpose.

The Advantages of Good Organization. The well-organized business has several very important advantages over a competitor whose business is not so well organized. We shall consider these advantages as they accrue to an executive in the shop. But it will be evident that they also apply in the office, the store, the railroad, the bank—everywhere, in fact.

First, in a well-organized shop, the executive has effective control over the efforts of each member of his working force. Without giving up his control over any part of the work, he delegates authority to assistants, each of whom supervises and is responsible to him for some definite portion of the work. The executive can then devote his own time largely to co-ordinating and improving the work of his assistants.

The executive in a poorly organized shop is unable to do this. He is, as a rule, swamped in detail. He is very busy doing work that should be delegated to assistants; and he probably falls behind with his work. Without

efficient organization, the most capable executive is unable to accomplish much. His time is largely wasted on work that does not require a man of his capability.

Efficient organization releases an executive from repetitive detail, and allows him opportunity for supervisory and creative work.

Also, an executive in a well-organized plant can tell definitely which of his employes is responsible for each act that is performed. He can single out the better from the poorer workers. This cannot be done so well in a poorly organized shop.

Clean-cut organization places definite responsibilities on each member of the working force.

Again, the workers in a well-organized shop can specialize in their work—do relatively few things and do them well. This is an important advantage. Men who are highly skilled in one line are much easier to obtain than men who are highly skilled in several lines.

A poorly organized shop requires more expensive all-round men, because the work is not organized to keep men busy on the same kind of operations so far as possible.

In a well-organized shop, each worker is given definite tasks and responsibility, the necessary authority, and is made familiar with the most efficient methods of doing his work—and is therefore able to work most effectively. He is much less likely to turn out slipshod work than is the man in a poorly organized shop.

It is evident, also, that—

Clean-cut organization promotes satisfaction in work on the part of all workers from highest paid executive to the youngest apprentice.

Such are some of the important advantages of the well-organized shop. Substantially the same advantages accrue in the well-organized office or bank or store or any other kind of business.

THE MANAGEMENT OF AN ORGANIZATION

Management is responsible for the development of an organization that can successfully carry out the policies of the business, and management is responsible, as well, for the work of that organization in carrying out those policies.

Management is an art that requires accurate knowledge of the human characteristics—aims, hopes, motives, sentiments, prejudices, etc. — of the individuals and groups of individuals who compose the organization. This understanding of human nature underlies power to lead men successfully, and to bring them all into harmonious relations, in compliance with the policies of the organization.

Management builds up an organization for effective control in successfully carrying out its operating policies.

The term “control” designates the methods by which the executives of a business use their authority to regulate its affairs in accordance with the policies of the organization. Control may be of the following types:

1. Line control.
2. Line-and-staff control.
3. Functional control.

Committee co-operation is sometimes spoken of as a fourth type of control, known as committee control.

The relationships between departments and the scope of activities and limits of authority of various officials and department heads are seen most clearly when we draw a chart of the organization. Such charts usually represent the leading departments by rectangles or circles. These departments are then connected by lines which show their relationships to one another. We shall use charts to illustrate different types of control.

What Is Line Control? The term “line,” in military usage, means the line of succession in command. In

military line control, the plan of campaign is often not disclosed by the commander in chief to the line officers.

Previous to the development of the modern system of staff officers, the commander in chief planned out which way the divisions should march, where they should seek shelter, how they should be provisioned, where bridges and roads were to be built, etc. He gave his orders at the proper time to the line officers next below him in rank, who turned the orders over to other officers down the line.

In line control, as applied to industry, the works manager gives orders to his immediate subordinates and they pass the orders down the line until they reach the foremen. Each foreman is responsible for everything in his own department or shop. He must see that the proper sequence of work is observed; that he does not run out of orders; that he keeps up with the work in hand; that he is provided with the necessary materials, supplies, and tools; that he is not extravagant with these; that the work is done; that it does not cost too much; that his men are satisfied; and that his machines are in effective working order.

In line control, orders travel from the top down in the direct line of authority. Line control places full authority for carrying out orders, and determining how they shall be carried out, with the executive at the point in the line where they are to be actually carried out.

Line control is well illustrated by the divisional organization employed in many railroad systems. Here the division superintendent is given absolute authority over the activities and methods of his division, and is held responsible only for results. Divisional line control is found in some large manufacturing plants. In one agricultural implement plant, for example, the respective shop superintendents may have absolute authority as to methods, wages, and manufacturing policies. Conse-

quently, the superintendent of one department might use methods entirely different from those used by the superintendent of another department; the superintendent of the gray-iron foundry might fix a wage scale different from that fixed by the superintendent of the malleable-iron foundry.

Line Control Charted. Figure 1 shows line control in a representative engine-building plant of moderate size.

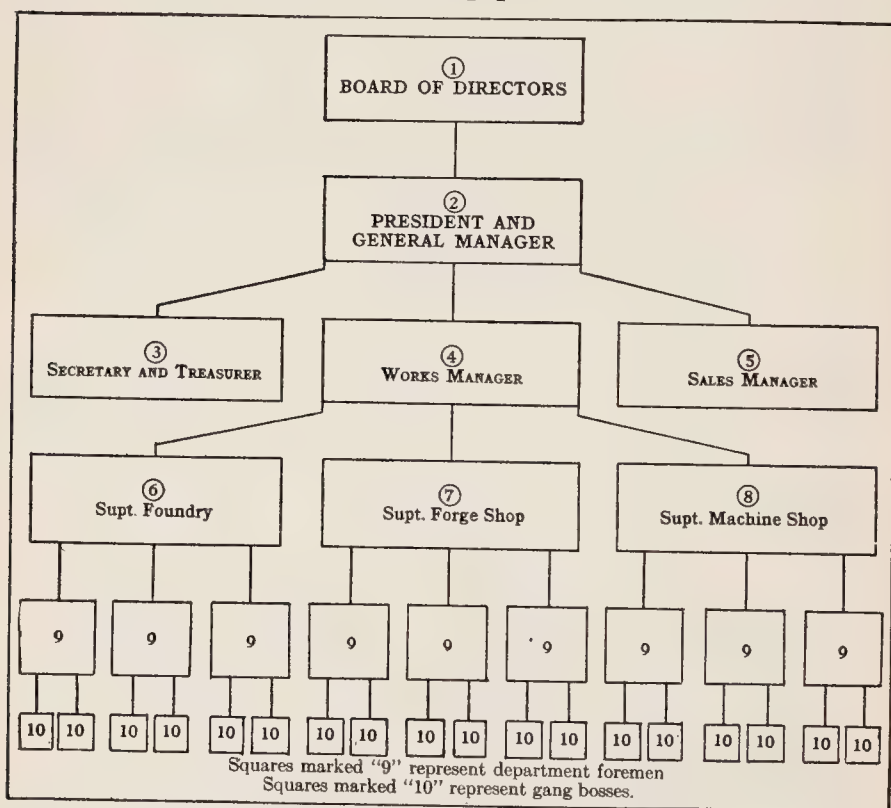


Figure 1. As indicated in this chart, line control travels from the top downward in a direct line of authority.

In this organization, the board of directors formulates certain policies, which are carried out by the general manager, who is free to adopt such methods as he sees fit.

The general manager has charge of three distinct divisions. These have to do with accounting, producing, and

selling, which are supervised, respectively, by the treasurer, the works manager, and the sales manager.

The works manager has jurisdiction over the production superintendents—the superintendent of foundry, the superintendent of forge shop, and the superintendent of machine shop. Each of these superintendents has jurisdiction over a number of foremen (9). Each of these foremen has jurisdiction over a number of gang bosses (10), and the gang bosses give the orders to the men in the ranks.

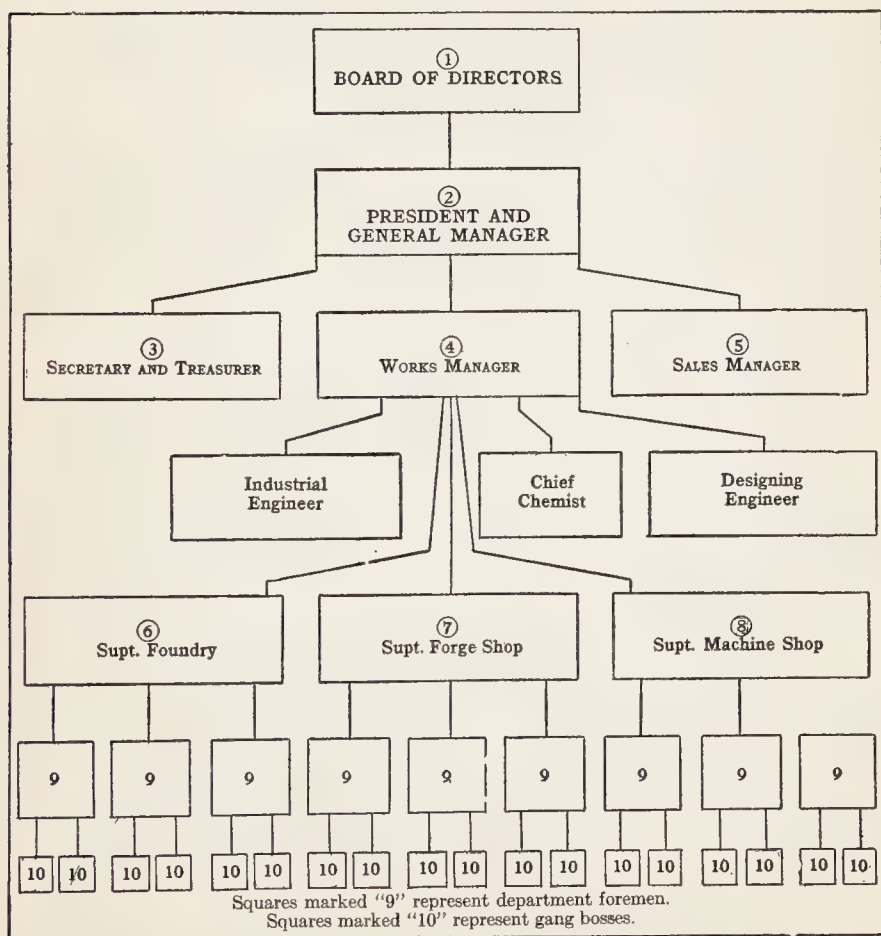


Figure 2. Line and staff control is a modification of the line control method of an organization wherein staff specialists perform specific duties.

Line and Staff Control. Cæsar and Napoleon employed line control. It was General Von Moltke who developed the staff principle. He appointed special officers on his staff, each having a field in which he was an especially well-trained expert. Thus, one member of the staff supervised engineering features, another the commissary, etc.

Industry also began to avail itself of the expert knowledge of men with special training and ability, as in the fields of engineering and chemistry. To-day owners and general managers employ staff specialists of many kinds.

As indicated by its name, line-and-staff control is a combination in which the line principle is modified by the use of certain staff specialists.

In military line-and-staff control and in its industrial and business analogies we find the staff officers and their assistants working out special problems and making their recommendations to the chief, who issues orders, thru his line officers, which are based in part on the expert advice of his staff officers.

In Figure 2, the works manager is now assisted by three staff specialists—an industrial engineer, a designing engineer, and a chemist. These staff specialists, however, have no authority to issue orders, except to the assistants in their own departments. They report to the works manager on the technical matters in which they are specialists.

The industrial engineer has charge of installing the management systems and prepares the various "procedures" which describe the operation of the systems. All organization and system matters are referred to him and pass thru his department. He reports on them to the works manager. Orders are then issued by the works manager.

Line-and-staff control is also used in other parts of business. A sales manager may have a research man on his staff. The treasurer, when faced with a cost-account-

ing problem, may have an expert cost accountant on his staff. The general manager may call in an expert in business correspondence to suggest ways and means of improving the letters written in various departments.

Such are examples of line-and-staff control, which means staff advice added to line control.

If the manager authorizes the expert to carry out his advice or recommendations in the company, and makes him responsible for results, then we have "functional control."

Functional Control. Management has many widely differing functions to perform. Production management, for example, deals directly with materials, one group of functions; with machinery, another group of functions; with men, still another group of functions, etc. No one executive is likely to be equally well fitted to deal with machinery and men, or with methods and materials. One man will function best in one field, another in another.

Organization of the work of a group of executives so that each is responsible for the particular phase of work in which he functions most effectively is the basis of functional control.

In this type of control the works manager will be assisted in selecting men by an employment manager, who finds men for all departments; the responsibility for the order of work and its routing thru the shop is given to another member of his staff; etc. Functional experts control such work directly, and are not confined merely to giving expert advice to the works manager, as is the case in line-and-staff control.

Functional experts not only make rules telling how things should be done, but are themselves responsible for having them done that way.

Each functional expert, or boss, either personally or thru assistants, deals directly with the foremen, and in some cases with the men, who perform the function in which he is an expert.

Functional control of certain phases of work is common in the large businesses and industries. The purchasing agent, the employment manager, the maintenance and repair manager, the chief timekeeper, and others, are responsible for those particular functions of management in and for all departments.

Functional Control in the Shop. In recent years the progress of scientific management has shown so many ways in which the expert knowledge of specialists is of advantage as applied in functional control, that this kind of control has been extended to many details of shop practice which were formerly handled by superintendents and foremen.

The extent to which functional control may be applied is suggested by considering some of the leading questions that are assigned to functional experts for answers, as follows:

1. *How is this work to be done?*

This question is answered in a preliminary way by the designing engineer, and in a more specific way by a method or operation or production engineer.

2. *What materials, equipment, tools, gauges, fixtures, etc., are needed?*

This question is answered by a preparation supervisor, who takes the complete designs of the designing engineer, the lists of operations of the operation engineer, and then prepares complete specifications for all materials needed (usually called materials lists) and also complete lists of equipment, tools, fixtures, etc. (usually called tool lists), which it is necessary to secure in preparation for any work.

3. *What class of operator is to do the work? How long will it take? How much should it cost?*

Such questions are answered by a functional supervisor, who provides the necessary research work, includ-

ing job analysis, time studies, and cost investigations, to enable him to prepare detailed instruction cards and predetermined times and costs for every operation.

4. *When is the work to be finished? When must each part or group of parts be started?*

Ability to answer these questions implies an understanding of how each operation fits in with all the rest of the work to be done in the establishment. They are answered by a functional supervisor, who takes into consideration actual and probable sales, manufacturing programs, stores, raw materials, partially worked material, finished parts, the number of employes, and the amount and character of equipment available. He establishes a definite date for the performance of each operation necessary on every job. He is usually designated as the scheduling supervisor.

Such functional supervisors, in some organizations, report directly to the works manager. Generally, however, they report to a production manager, leaving the works manager free for his other executive duties.

5. *What methods of inspection and tests are to be employed to reduce errors and defects to a minimum?*

This matter is usually taken care of by a functional specialist known as an inspector, who, with his assistants, is responsible for maintaining the company's standards of workmanship and quality.

Chart of Functional Control. Figure 3 shows how the authority is delegated by the works manager under functional control. (This chart is not necessarily complete. The works manager may also, and often does, have certain staff advisers and assistants, such as designing engineers, who have no direct authority over work in the shop. For the sake of simplicity, these staff experts are not shown on the chart.)

The left-hand section of the chart shows the delegation of authority in managing the men, and in maintaining

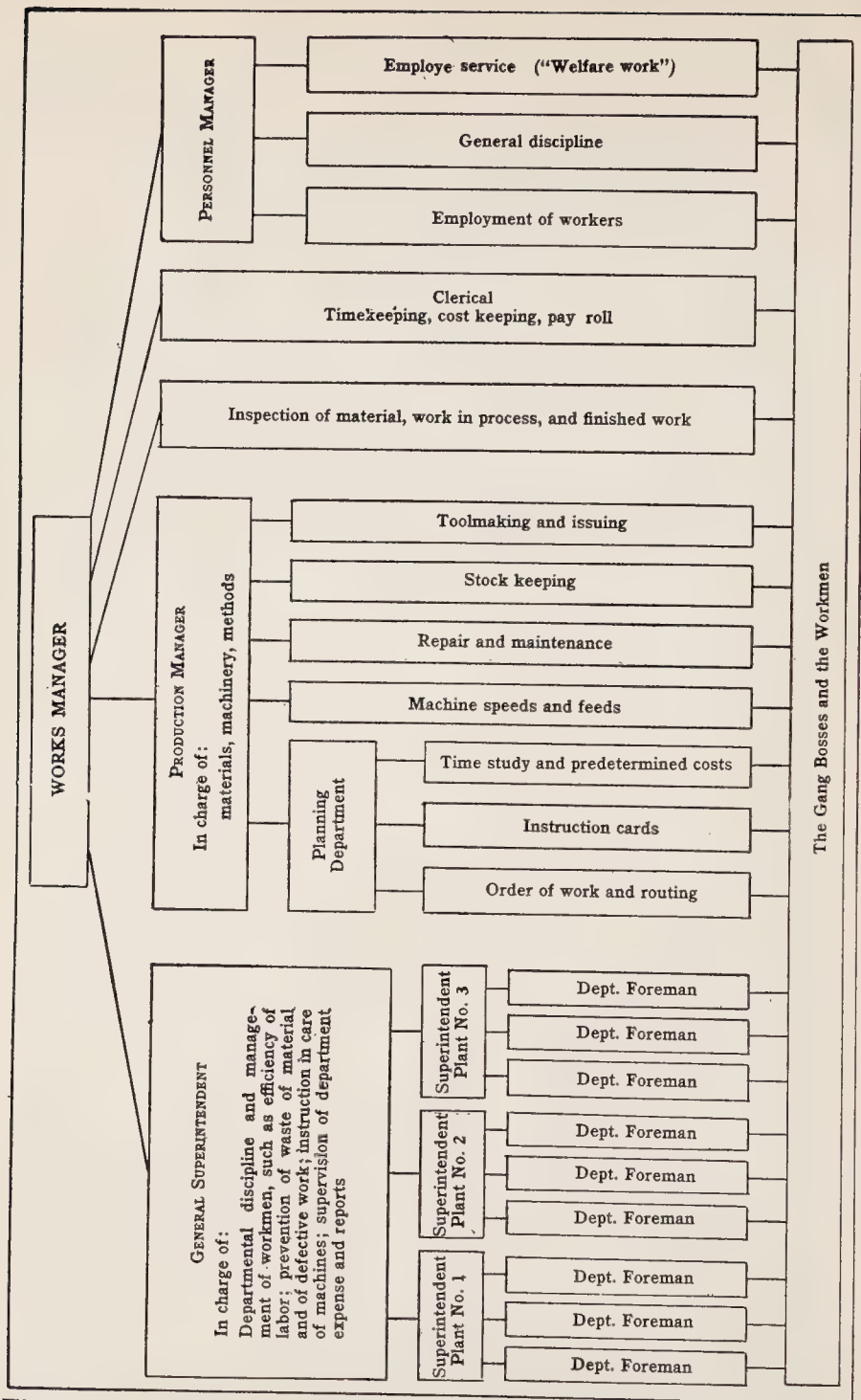


Figure 3. This chart indicates the functional control method of organization by which authority is delegated to specialists who are held responsible for certain work in various departments.

effective departmental discipline, as well as the delegation of the responsibility for getting the men to work efficiently, so as to avoid waste due to defective work, to prevent abuse of the tools and equipment, and to keep down the "controllable overhead," expenses for supplies, for departmental maintenance, etc. The function of the various superintendents and department foremen is largely that of managing men, and deals but incidentally with materials, machinery, and methods.

The production manager is the executive who deals, almost entirely, with material, machinery, and methods, and with the workers largely as human machines, altho his supervisors, in dealing with the men, must use tact to gain their co-operation. These supervisors are directly responsible for the planning of all the work down to the last detail, and for making sure that the plans are understood and intelligently carried out. This brings the supervisors who carry out these functions into direct contact with the gang bosses and in many cases with the workmen.

The inspection department is charged with the special responsibility of inspecting the work turned out to make sure that it is up to the standards set by the engineering department, that wastage is not excessive, etc.

A great deal of clerical work is needed thruout a manufacturing plant. The time put in on all jobs must be noted; the time the men work, giving a basis for payment; etc. This work is very often put under the responsibility of a functional head, as shown in Figure 3.

The personnel manager has charge of the human relationships of industry. His activities will be fully explained in following manuals.

Functional Control in Business. Altho functional control has been most highly developed in large and intricate industrial plants, it is widely applied in other kinds of

business. In a modern department store, for example, the sales people may be supervised, perhaps indirectly, by a functional employment department, a training department, a welfare department, a pay-roll department, etc.—all in addition to supervision by the head of the department in which they work.

The tendency in all lines of business and industry is toward greater functionalization of control—the delegation of responsibility and authority for certain phases of work to specialists who supervise their respective functions in all departments.

The larger the business or industry is and the more complex its relationships and processes, the more evident is the tendency toward functionalized control.

COMMITTEE CO-OPERATION

Under any one of the three plans of organization explained in previous pages—whether line, or line and staff, or functional—management may often gain valuable assistance and advice thru the co-operation of committees made up of executives and representatives of the men.

Under this plan, standing committees are appointed to consider or take charge of specific functions, and special committees act from time to time on matters of new methods and policies. In some cases these committees take the place of the staff advisers in a line-and-staff method of control.

It has been claimed that in industry and business, as well as in private life, there could be no successful attempt at government without the consent of the governed. The advocates of democracy in business and industry claim that the committee system with meetings at regular intervals is most productive of loyalty and intelligent co-operation.

Committee meetings afford an opportunity for discussing methods proposed by staff specialists or by line execu-

tives, and give the chance for looking at these proposals from various angles. They afford an opportunity for adverse critics to express themselves and at the same time give the proposer a chance to defend his proposal. Committee meetings also provide an opportunity for the various heads to get better acquainted with each other and to recognize the good points in each other's characters, and for both management and men to get each other's point of view.

Suspicion and misunderstanding are the sources of most industrial discord, and these tend to disappear in the informal discussion of a committee composed of management and workers, where each can get the other's viewpoint direct.

Typical Kinds of Committees. Among the various committees which report to the general officers of a company, the following are representative:

1. The manufacturing committee, which recommends the manufacturing program for product and parts, and discusses the general status of orders from customers and for stock.
2. The tool committee, which recommends new tools if it considers that all the conditions justify them. It also selects the most important needs for tools to be met.
3. The committee on new designs or new products.
4. The committee for considering cost reductions and economies in general.
5. The suggestion committee, which considers all suggestions as to improvements and decides on the awards for the best suggestions.
6. The committee on complaints.
7. The safety committee, which makes recommendations for safeguarding machinery and for providing conditions favorable to the health and physical well-being of employes.
8. The welfare committee, which considers such matters as social activities, athletics, library, home betterment, etc.
9. The educational committee, which considers the apprenticeship system and methods of providing specialized education for all classes of employes.

Thus the principle of committee co-operation is wide and flexible in its application. It will be considered in

detail in the major section of this training plan which takes up the problem of managing men.

DEPARTMENTAL SPECIALIZATION

Two basic tendencies of modern industry and trade are combination and specialization. The developing of large organizations and the combining of small undertakings into large ones, with more work of each kind to be done in the larger organization, naturally paved the way for minute specialization.

In the administrative field of business, the principle of specialization first appeared in a division of management into production, selling, and accounting. In production, this principle appeared in the departmentalization of factories. An early case was that of a metal-working factory, which was divided into foundry, forge shop, pattern shop, and machine shop, with the designing and drafting done at first by the superintendent and his assistants, and later by a distinct designing and drafting department. Separate departments for distinct processes in the machine shop, such as the lathe department, drill-press department, and screw-machine department, appeared later on.

Specialization under Functional Control. The left-hand section of the chart shown in Figure 3 (page 12) illustrates the departmental subdivision of a modern plant which is under functional control. That chart serves equally well to show the departmental subdivisions for line control and line-and-staff control, the only difference being that the responsibilities of superintendents and foremen would be greater than under functional control.

Under functional control, the foreman's duties do not include those special functions assigned to the functional experts, but the foremen must still be specialists in the work of the department, since they instruct the men and assist them in doing their work in accordance with instruction cards.

Plant No. 1 in Figure 3 is a machine shop with a superintendent at its head. Under him are a foreman of the tool room, a foreman of group assembly, and a foreman of the machine-tool department. The last named has under him gang bosses—one in charge of the lathes, another in charge of the drills, another in charge of the automatic screw machines, etc. Under each gang boss are workers each one of whom would have to know only enough to turn out acceptable work on the particular machine which he was attending.

With the expansion and enlargement of shops, the work of the individual workman tends to become more specialized.

The all-round mechanic has become practically obsolete. Most workers in the larger industries are proficient in some one task; they soon learn to do one thing almost automatically.

The Problem of Monotony. But to perform the same task continuously, day after day, and even year after year, has been found to have a deteriorating effect upon the worker's body and mind.

It has been claimed that the loss due to human deterioration from this cause is greater, from the viewpoint of public welfare, than any gain the consuming public has made by the greater speed and lower cost of labor achieved when men are kept continuously at work on one monotonous operation.

How can this serious defect in modern industry be remedied?

To return to the older, simpler days would be an economic step backward; it would necessarily lower the living standard of workers; less would be produced for consumption.

Fortunately, plans have been worked out by which the vigor of spirit, mind, and body can be maintained, notwithstanding a certain monotony of daily tasks.

The key word in these plans is *opportunity*. A person who sees opportunity ahead to gain something which has a strong appeal to him will to a large extent ignore the daily grind, because it is a stepping-stone to the realization of his desires.

Ambitious men crave promotion. Enlightened management, therefore, provides training courses for its employes and gives them opportunity to earn advancement. Opportunity for advancement and preparation to grasp that opportunity stimulates interest in their work, as well as avoidance of diversions and vices which hasten the deterioration that results from monotony of work.

Enlightened management encourages pleasures and interests that will stimulate the men and fill their off-duty hours with a profitably pleasureable contrast to the monotony of the work. And, of course, management will seek, in every way that is consistent with real efficiency, to relieve the monotony of the work itself.

In proportion to the monotony of the daily tasks of its workers should management feel responsible for providing the workers with opportunity to satisfy their ambitions.

Types of Control Compared. Line control is avowedly autocratic. It demands unquestioning obedience to the executive in line just above. The matter of obtaining results is put up to each succeeding lower executive in line by the executive over him. The danger is that the lower line executives (say, the foremen or gang bosses) are likely to put it up to the men in the ranks to get greater results than are possible without the co-operation of the executives in line above.

Line control demands the greatest degree of all-round ability on the part of each officer and each man in the ranks.

Line control may be and often is remarkably successful in businesses and industries of moderate size. It is, in fact, the only practical form of control for the small

one-man business. Its success depends on the broad-minded skill of the chief executive and on his success in choosing line officers who will carry out his ideas with enthusiasm and sympathy.

Line-and-staff control recognizes the value of special education and training and accepts the advice of specialists. However, there is likely to be a considerable mental reservation on the part of line officials as to the desirability of certain staff recommendations. This often results in a failure to carry out the recommendations of the staff. Nevertheless, there is no question but that in a large or complex enterprise it is a great advance over the all-line type of control, and it has superseded the latter in practically all industries which require expert engineering and chemical skill, such as in the steel industry and in chemical manufacturing.

Functional control brings the expert into touch with the worker; the expert guides the worker in his daily routine.

When functional control is first introduced in a shop, it is often strenuously resisted by the executives of the former line organization, who resent interference with their autocratic authority. But industrial managers know how to handle this difficulty, and functional control is rapidly coming into wider use in industry.

In almost every large industrial center we find factories in which such matters as routing, scheduling, and instructions to men are being taken care of by functional supervisors, and almost everywhere now the matter of employment is being functionalized.

Charting the Personnel of an Organization. The charts of different types of organization, as shown in Figures 1, 2, and 3 on previous pages, make no reference to officials or department heads. But in preparing an organization chart for a business, it is desirable first to chart the per-

sonnel of the existing organization and show the extent of responsibility and authority of each executive.

It will nearly always be found that the organization has been developed to accommodate itself to the personal strength or weakness and the specialized knowledge or versatility of various individuals.

When we consider the fact that a business must carry on effectively altho its officers and other executives, one by one, drop out of service in the course of time, it is apparent that the departmental and other divisions of the organization should be the kind that permit the filling in of occasional vacancies advantageously.

One of the great advantages of having an organization that conforms to the divisions of an ideal organization chart is the facility it affords in maintaining full strength in the personnel of officers and other executives.

Altho it is advisable to have an organization which as nearly as possible conforms to the demands of the commonly accepted ideal chart of organization, great care must be taken when making changes in this direction. Changing the responsibility and authority of executives is difficult and cannot be done overnight. The friction and resentment which too sweeping a change can cause might wreck the morale of an organization. It frequently happens that the realization of an ideal organization chart must be deferred for some years.

At all times it is important that the various officials, department heads, and other executives of an organization, as well as the minor employes in the various departments, understand exactly where they stand in the organization and to whom they are responsible. Hence, an organization chart should be prepared showing the actual present relationships of departments to each other and the lines of responsibility and authority of the various officials. If any immediate changes are to be

made, these should be effected in the organization before the chart is made public.

Figure 4 is a chart which shows the relation and functions of each important executive in an automobile-motor manufacturing company. The names of the department heads were inserted in the rectangles and blue-print copies of the chart were distributed to the

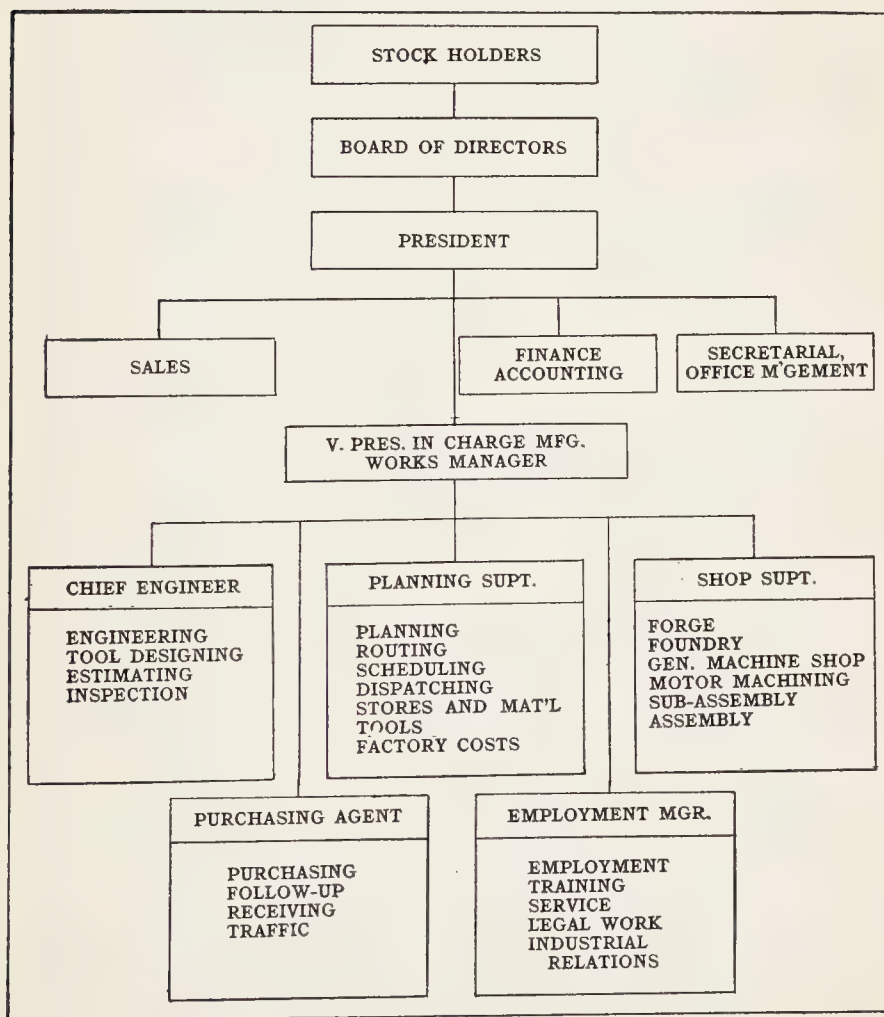


Figure 4. This chart is used by a large automobile motor manufacturing concern and shows clearly the functions of each executive and his department and the relations of the various departments to each other.

various department heads and posted on the various bulletin boards in the shops and offices.

In many cases there are good reasons for treating an ideal or ultimate organization chart—showing the divisions toward which it is desirable to develop the organization—as confidential information for the use of the company officers. But the chart of the existing organization should receive wide publicity among the men as well as the executives. Such publicity will prevent many misunderstandings and help employees to get a clearer understanding of the business as a whole.

Charting the Course of Work. A chart of executive and departmental responsibility serves to facilitate the work of routing orders thru the various departments.

Where goods of standard design are manufactured for stock in large quantities, the orders may originate with the general manager. He may order certain quantities of standard items to be made up for stock in accordance with the company's standard practice, as when the general manager of a cotton mill puts in an order for 100,000 yards of a certain standard grade and width of sheeting.

In an automobile company, the design for a new model of car is first thoroly worked out by the engineering department. Complete experimental models are made up and tested in the experimental department. Then the general manager delivers complete specifications and drawings to the works manager and orders a specified number of cars of that model made up for stock.

Some companies manufacture goods to fill customers' orders and specifications. The automobile-motor manufacturing company whose executive organization is charted in Figure 4 is an example. In such cases, the progress of an order is somewhat more complicated; it is charted in Figure 5.

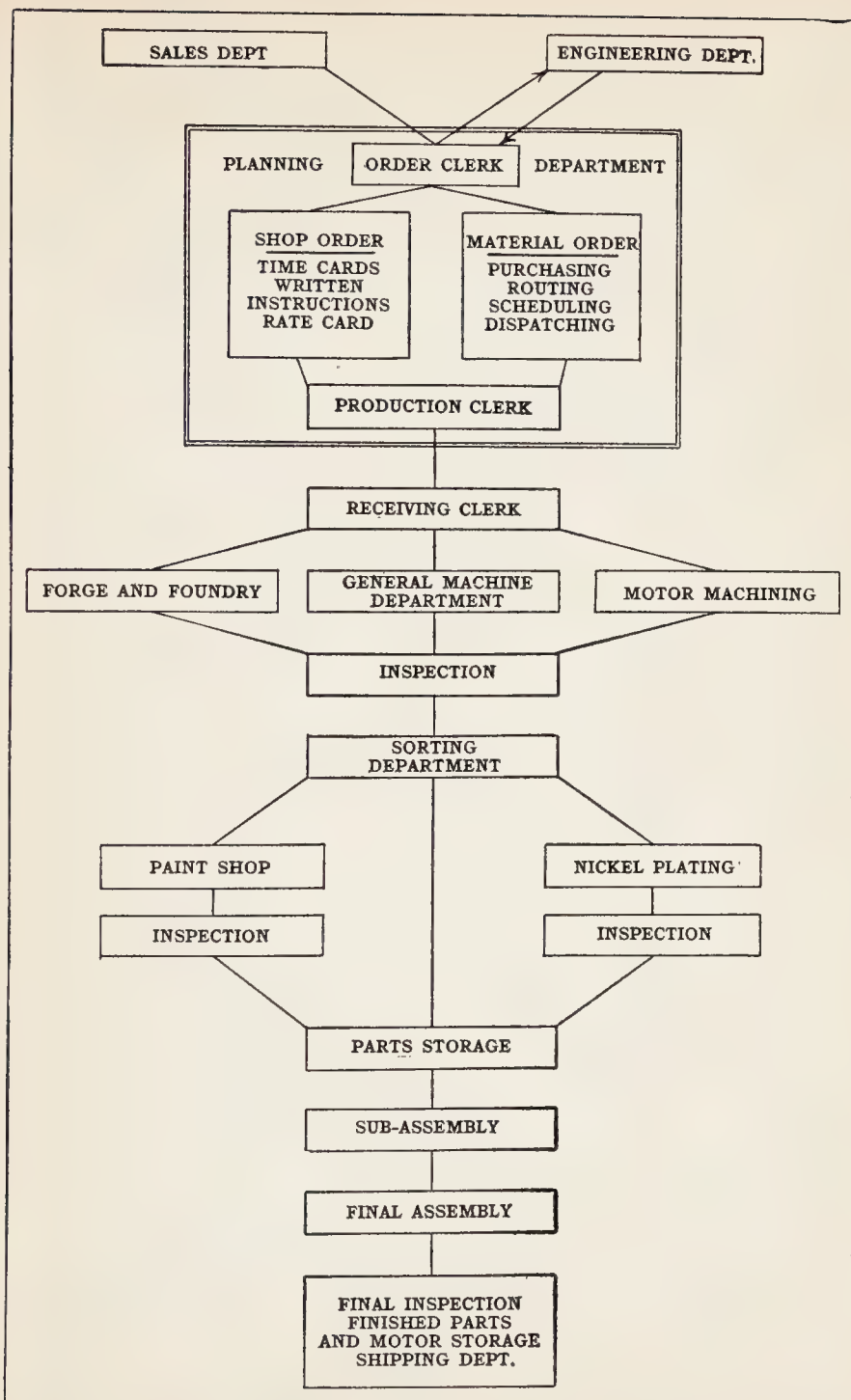


Figure 5. In concerns where products are manufactured according to customer's specifications the progress of an order thru the various departments is sometimes a rather complicated matter as indicated by this chart which is in actual use by the concern whose organization chart is shown in Figure 4.

In this company the order from the sales department goes to the work manager (see Figure 4) and to the order clerk's desk in the planning department (see Figure 5).

The order is entered and three copies start in three directions. One copy goes to the engineering department, which returns instructions as to material and standard parts to be used; also drawings of any new parts, and complete specifications. The engineering department also notifies the inspection department of the tests that must be met.

Another copy of the order is given to the shop order clerk, who issues orders to the various shop departments for the work each is to do, together with instruction cards, rate cards, etc.

The third copy of the order authorizes the purchasing department to order the materials specified, and the stores department to issue the necessary materials and parts to the shop. This third copy of the order is also used to route the work thru the shop, so that it may be completed within a given time.

Instructions from all these sources go thru a production clerk, who issues suborders to the shop department.

From this point on, this chart (Figure 5) explains itself. The work flows from one department to another and everywhere finds orders awaiting it, instructing the department heads what to do, just how to do it, and when to do it. Functional supervisors take the responsibility for this, and another group of men inspect the work at every step of the way.

It is worthy of note that in this routine the parts stock room is the clearing house to which all parts or groups come and from which they issue when needed for assembly. This method of procedure makes it easy to inspect individual parts and facilitates control over the flow of material. It prevents the usual disorder when the shop floor is used as a storeroom.

Where work can be very closely scheduled, as it is, for example, in the Ford plants, it is better to have the manufacture of parts so timed that all will reach the assembly floor at the right time and in the right proportions to make up finished stock. Such close scheduling is practical, however, only when comparatively few different kinds of articles are made in one plant.

Such are some of the important features of organizing the flow of work in an industrial plant, enough to give us a concrete idea of the problem. Our grasp of organizing principles will be broadened and strengthened in succeeding manuals.

DEVELOPING ORGANIZING ABILITY

Success in positions of responsibility hinges largely on a man's skill as an organizer. Every intelligently ambitious worker strives to develop organizing ability. The first step in this development is to organize yourself—your own time and your own work. This will give you keener interest in your duties, as well as self-discipline in performing your self-assigned routine tasks.

There is always opportunity to develop organizing ability in systematizing materials and tools in an orderly way, whether your work be mechanical or clerical. The manner in which an executive keeps his desk “tools”—his files, his records, his stationery, etc.—and the orderliness of all his arrangements should be a matter of careful study.

The man who would be a good organizer of men and methods begins at home—on his own desk or bench, or in his traveling bag or sample cases if he is a traveling salesman.

Opportunities for planning and systematizing work can always be found by every worker as well as every executive. The same principles apply whether you organize only your own work or have supervision over the organization of the work of others.

Practical Steps in Organizing. In developing a plan for the organization of work, these six steps can be profitably followed.

1. Set down the exact purposes or objectives of your department or your work.
2. Make a preliminary survey of everything which has to be done, including your own duties.
3. Make a detailed and analytical investigation of all the steps taken and the conditions involved in the work, and its relation to other work.
4. Compare these steps, conditions, methods, and relations with the best-known standards, and determine how, in so far as practical, to bring your work or the work of your department up to the level of the best standards.
5. Determine how these conditions, activities, and relations can best be controlled to insure prompt, efficient work. Make the most appropriate selection and application of the principles of specialization, and of line, staff, functional, or some combination of these types of control.
6. Record the results of your decision in the form of graphical charts, written records, and instructions.

You doubtless recognize these steps. They cover the same ground as the first four processes which are listed in the outline on page 34 of Executive Manual 33, which tells how scientific management is applied. In following manuals, these steps will be more completely developed.

Valuable training in organization planning may be gained by charting the organization of factories, stores, banks, or any other kind of business organization. Get information about them by observation and from your associates. You will doubtless be surprised at the illogical paths of authority and work that the charts of some organizations will disclose. Your ingenuity and knowledge of organization principles, as presented in this and following manuals, will be tested by working out ideal charts in which the activities are scientifically rearranged.

In developing ability to attack important business problems scientifically and work them out successfully, let us now, in Part II of this manual, take up a brief

study of the factors to be considered and methods to be employed in determining upon the right location for a business. We shall see that location is one of the outstanding problems of industry. In developing ability to handle this problem, we shall at the same time be developing ability to follow the best method in handling all kinds of business problems.

ORGANIZING FOR CONTROL

Part II

LOCATING AN INDUSTRY

When an industry is about to be started, or when consolidation of small units into a larger combination has taken place, the important question of the most profitable location for the industry comes up for consideration, to be solved by analysis and investigation.

Analysis of this question reveals, first, the problem of the general location—that is, determining the particular part of the country (such as the city or town)—and second, the question of the site within or near that location.

Factors That Determine the Most Profitable Location.

Analysis of factors that determine the general location reveals the following considerations:

1. Raw, semifinished, and finished materials, supplies, and accessories essential to carrying on the business.
2. Power required; whether purchased electric power, water power, gas power, or steam power from coal is available; the cost of each, and which is preferable.
3. The effect of climate upon production.
4. Transportation facilities.
5. The desirability of water transportation.
6. Labor supply.
7. Inducements in the way of free land for buildings, cash bonuses, stock subscriptions.
8. Money markets.
9. Sales markets.
10. Nearness of other industries in the same or similar lines.
11. Prestige value of the location.

Analysis of factors that determine the local site, after the general location has been selected, brings up the following considerations:

1. Space for expansion.
2. Fixed charges due to high or low cost of land.
3. Local labor market.
4. Nearness of this local labor market to site.
5. Local transportation facilities for freight and workmen.
6. Fire prevention.
7. Convenience of customers.
8. Nearness to local trade centers.
9. Available power.

The weight given to each of the above factors will, of course, vary in different industries or lines of business. In fact, no two manufacturing plants or businesses should put exactly the same emphasis on all the factors above outlined. But let us remember that—

The selection of a location for any business, factory, or branch requires consideration of many factors on which accurate data must be obtained; and the relative importance of each factor considered must be determined.

Each factor will now be considered in further detail to see what is involved in applying this principle.

Materials and Supplies As a Factor in Location. If the materials required are few but bulky, it is likely that nearness to a good source of raw materials will be an important factor.

Some forty or fifty years ago, central Pennsylvania was dotted with small furnaces for making iron, because limestone and iron ore were plentiful, and hickory wood, used for coke, abounded. As production centers began to appear along the lines of the railroads, the cost of hauling from many of the country furnaces to the railroad lines became a serious handicap to these out-of-the-way furnaces. They could not continue in competition with furnaces near the railroads. Soon there was concentration of Pennsylvania iron and steel furnaces on certain railways at points convenient to the raw materials.

A new element appeared with the discovery of the Lake Superior iron fields. There the iron ore was so

accessible that it could be dug up with steam shovels and conveyed by machinery to the holds of vessels, which in turn were unloaded by machinery. However, the Superior iron fields were remote from coal; hence, the furnace industry spread gradually toward the lake ports where the combined costs of coal, iron ore, and limestone were lowest.

Where the raw materials are not so bulky and heavy, as in the textile industries, nearness to raw materials is relatively not so important. While cotton manufacturing has been gaining in the Southern States in recent years, at the expense of the New England States, this has been due to certain advantages in labor conditions more than to the advantage of nearness to the source of raw cotton. But it is true, in general, that—

The larger is the part played by the cost of transporting materials in making up the total manufacturing cost, the more weight should location of the sources of materials have in determining the manufacturing location.

Where the materials required in manufacturing are numerous and of a semifinished or finished nature, as is the case of assembled automobiles or farm machinery—requiring supplies of bar stock, bolts, nuts, washers, rods, etc., in great variety, as well as drop forgings and castings purchased mostly from jobbing shops—the most profitable market for raw materials will be a general metal-manufacturing territory, where lively price competition keeps the prices of materials at a relatively low level and where delays in securing supplies may be avoided. Nearness to manufacturers of finished accessories—such as radiators, magnetos, and tires in making an automobile—is important.

Such considerations have led to a concentration of automobile manufacturing in a territory roughly indicated by a line connecting Cleveland, Indianapolis, Lansing, and Detroit.

Power As a Factor in Location. Power is an especially important consideration in forging and in manufacturing glass, brick, tile, pottery, steel, and iron. There are also metallurgical and electrochemical industries which require a great amount of power. In an assembling business, power is relatively less important.

Iron and forging enterprises, for example, are located where cheap coal for power and nearness to raw materials are combined. Such a combination is found in Pennsylvania, Ohio, Indiana, Illinois, and New York.

The combination of clay and cheap gas fuel required in potteries is found in the gas fields of West Virginia and Ohio. The abundant water power in the vicinity of Lawrence, Lowell, and Fall River accounted largely for the establishment of textile mills in those centers. Cheap power, combined with cleanliness, has led to the establishment of the carborundum works and the shredded-wheat factories at Niagara Falls. It is apparent that—

The problem of locating a business most advantageously is to secure the best combination of all the factors to be considered.

Industries which purchase electric power to run their machinery now have wider choice in selecting suitable locations, thru the extension of the superpower networks which deliver adequate power over wide areas of territory. They can secure a better combination of location advantages.

The Part Played by Climate. Prior to the perfection of mechanical methods of humidifying, dehumidifying, heating, and cooling large bodies of air in factories, warehouses, kilns, etc., the natural climate played a more important part in the location of cotton mills, silk mills, and cigar factories. But the growing use of apparatus which produces, artificially, almost any climatic condition desired in the factory, has made climate a less impor-

tant consideration in manufacturing, altho its influence on the comfort and healthfulness of the workers in their life outside of the industry is an important consideration.

Efficient management always considers comfortable living conditions for the workers as an important factor in location.

Consideration of Transportation Facilities. There are three sides to the consideration of transporting facilities:

1. Cost of incoming materials and supplies.
2. Cost of transporting finished products to buyers.
3. The adequacy of transporting service.

Transportation includes all forms of conveyance—railroad, steamship, express, truck, mail, and even the airplane. Let us remember that—

The most advantageous location with respect to transportation is that which minimizes the combined costs of all forms of transport employed, and gives adequate transport facilities on both incoming and outgoing shipments.

In the manufacture of furniture, a factory located close to the source of lumber supply might have this advantage offset by the high freight on deliveries of the finished products and by the inability to make quick deliveries to customers.

Convenience to sources of raw materials and to sales markets for finished products is often gained by a location where several railroads converge, especially so if the converging railways are main lines, as found in such centers as Albany, Chicago, Kansas City, and San Francisco.

Adequacy of service is assured particularly where there is competition between transportation companies. While freight rates under present conditions are the same on competing roads, these rates are, in all probability, lower as a result of the competition; and the securing of commodity rates and prompt car service, as well as prompt

attention to tracers, etc., is facilitated by keen competition.

Water transportation is often very advantageous where it connects the plant with important sources of raw material or large sales markets, not only because shipments may then be made by boat, but also because of its usual effect in lowered railroad rates.

Lumber, iron ore, coal, and oil are some of the important commodities of which large quantities are carried by water-transportation companies. The docks and wharves at any of the inland ports where railroads and waterways converge reveal a great variety of goods shipped by water. Many finished goods, as well as raw materials, are carried by boat during the navigable season.

Certain inland cities afford many industries the advantage of competition between land and water transportation both from sources of raw materials and to sales markets. Some cities also furnish at low cost an adequate water supply for power and manufacturing purposes.

What about the Labor Supply? An industry requiring a large number of certain kinds of skilled or unskilled laborers has relatively a very important advantage in locating near an adequate supply of that kind of labor.

Immigration of unskilled labor from southern and eastern Europe tended to follow certain lines of distribution. New York, Pittsburgh, Boston, and Chicago were important points on these lines and hence were, and still are, profitable markets for a supply of this class of labor. Restriction of immigration, however, has cut down new supplies of unskilled or common labor. The work of common labor is more and more being done by machines—lessening the desirability of locating in or near the centers of this kind of labor.

Some sections of the country have developed centers

of population where an almost hereditary liking for certain trades requiring a medium degree of skill is found. In the smaller cities of Connecticut and New York State, for example, there is an abundance of labor proficient in operating automatic metal-working machinery. In the Cincinnati territory, machinists are plentiful. In Pennsylvania, steel and furnace workers in general are easily found. Industries requiring large numbers of highly skilled operators, as in engraving and lithographing establishments, usually find large centers of population the best source of supply for highly skilled labor.

Whenever an industry requires a large amount of specialized labor, it is more satisfactory to locate near a supply of such labor rather than induce labor to move to it.

Wherever the local market does not afford an adequate supply of skilled labor, it is advisable to train local labor for the industry's needs.

Special Inducements Offered. A growing industrial center will frequently offer special inducements to industries in search of a location. These may take the form of free sites for buildings, cash bonuses, stock subscriptions, or a combination of such inducements.

Free land alone is not an inducement unless it is well located, is subject to low tax rates, and affords opportunity for expansion. Moreover, the location of the town in question must be favorable in the light of other considerations.

Cash bonuses are not frequent. Donations usually take the form of buildings and sites, which revert to the donors in case the industry fails to keep its part of the agreement. The industry usually agrees to give employment to a specified minimum number of men. Cash bonuses are sometimes raised by a sale of lots adjacent to the land given to the new enterprise. Stock subscriptions are often desirable in order to secure the

co-operation of local investors in the enterprise. Let us remember, however, that—

Special inducements are a secondary consideration among the factors on which a decision concerning the most profitable location is based.

But special inducements, when coupled with other advantages, often make it possible to locate a thriving industry where, otherwise, it could not be located. Many an industry, handicapped by lack of room and capital for expansion, has been able to spread out in a new location by virtue of special inducements.

The Money Market. Every thriving industry requires a convenient and adequate banking connection. At one time industry and business had to depend very largely on near-by banks for adequate working capital. Location near banks of sufficient size to provide the credit needed was then essential. Now, however, the large city banks go farther from home in seeking customers, and extensive lines of credit can usually be arranged by large, well-established businesses, even tho the local banking service is not adequate to supply all their credit needs.

Smaller business concerns, however, must depend more upon local banking facilities. A bank connection of the right kind not only provides what credits may be needed but also gives sound financial counsel. This matter is fully explained in the major section of this service on financing a business.

Location and the Sales Markets. Some important industries made their start in the most profitable sales market. Then, after the business had been developed and a strong sales organization built up, they moved to a new location where other advantages were more important, in some cases using the old site as a branch factory.

Places where buyers congregate in large numbers afford an important advantage for many concerns that are just starting in business.

Buyers of furniture congregate at Grand Rapids in the summer and winter during certain weeks to inspect new styles. Furniture expositions are conducted each year in Chicago, New York, St. Louis, and San Francisco. A new furniture factory might well consider carefully the advantages of being near to one of these markets.

Buyers from various parts of the world go to Cincinnati to inspect machine tools. Therefore, numerous small manufacturers of machine-tool specialties have found it advantageous to start in Cincinnati.

The Prestige Value of a Location. There is sales value in certain locations. The fact that good watches have so long been made in Elgin or in Waltham gives prestige to any watch made there. Minneapolis flours sell more readily because of the many widely and favorably known brands made there. The fame of Niagara Falls adds to the salability of a well-known breakfast food. A manufacturer of surgeons' specialties might do well to locate in Rochester, Minn. The buying public would not expect dainty linens to come from a city which is noted for its dingy barrenness.

The city in which an industry is located may either add to or detract from the salability of the product.

Once an industry has become associated in the public mind with a certain location, there is danger of losing prestige in making a change.

SELECTING THE LOCAL SITE

When the town in which an industry is to be located has been determined, there remains the important matter of finding the most profitable site in or near the town.

There must be room for expansion, and the fixed charges due to interest on the investment in land and taxes must not be too high. There are other important considerations, as follows:

The Local Labor Market. A fluctuating supply of labor is always a severe handicap. A location which attracts permanent workers rather than "floaters" is desirable.

Most employes do not like long rides on street cars or on commuters' trains. Hence, a location near the homes of the people who compose the working force of the business is an advantage. Nearness to the workingmen's homes also makes it easier to develop athletic and social activities which foster personal relations that tend to keep employes working together more happily and co-operatively.

The Local Transportation Facilities. If the factory is frequently visited by prospective customers, the question of local transportation is important. Furthermore, there is nearly always a considerable proportion of employes who will have to be drawn from localities outside of walking distance from the plant. Street car or bus service to the plant is usually necessary.

From the viewpoint of the greatest advantage in freight transportation, it is desirable to be located at the intersection of several railroads or on a belt line, and in a locality where teaming or auto-truck service to depots is not a heavy expense charge.

Fire Prevention, Water Supply, and Sanitation. A suburban site may be remote from effective fire protection. The cost of installing and maintaining an adequate fire-prevention system is often considerable.

Similarly, the adequacy of water-pipe lines and sewers and the cost of installing private lines need consideration.

Nearness to Local Trade Centers. If the industry is of an assembling nature, requiring the purchase of small items of raw material or of parts on short notice, it is important that the site be near the local sources of supply of such items, as remoteness would cause delays.

Convenience of Customers. Sales departments may be located elsewhere than at the plant. But in some lines, so few customers come to the firm's offices that their convenience may be ignored.

In many industries, especially in the smaller ones, the sales office and display rooms are grouped with the manufacturing department, and the convenience of the customers may be the determining factor in selecting a location. Manufacturing opticians, for example, often pay high rents for somewhat unsatisfactory plant conditions so that they may be near the largest number of oculists and retail opticians.

Although sales considerations should in many cases largely determine plant and warehouse locations, the tendency, particularly in the larger cities, is to have separate locations for the sales and manufacturing departments.

Frequently the general offices of the company, and in some cases the offices of buyers of important materials and supplies, are, with the sales department, located away from the plant at a point that is more accessible for their many personal contacts with outsiders.

INDUSTRIAL SURVEYS

In order to aid business men who contemplate locations in a given industrial center, we frequently find boards of trade, commercial clubs, or municipal commissions employing expert industrial engineers to prepare "industrial surveys."

These surveys report on the nature of the leading industries in the locality in question, number of persons employed, amount of money invested, bulk and value of output, and to what points the output is shipped. They also report on the various location factors analyzed in preceding pages, setting forth the special advantages of the town for certain industries. Industrial surveys are taking the place of haphazard solicitation of new indus-

tries. They afford much of the exact data needed for consideration by the officers of industries which are seeking a new location.

Incidentally, industrial surveys also assist bureaus of vocational guidance in giving young people a view of the local field of employment.

Figure 6, an analysis of factory sites, is an outline analysis of the factors which the industrial-research department of a large railroad considers important. This analysis could well serve as a basis of an industrial survey. It indicates the various location factors, which, with a few minor changes to cover any individual business, may be used by anyone in making a comparative rating on a percentage basis of present and prospective sites or of prospective sites, one against another. In using the outline, the railroad officials give this warning:

"The most important thing is to be sure that the data you obtain is not guesswork, general opinion, or hearsay evidence. Your information must be proved facts, sound and logical, obtained from an authoritative source and vouched for by men of known experience in these important fundamental factors."

THE USES OF LOCATION ANALYSIS

Whether or not you are ever faced with a location problem, there are other practical uses of the principles that apply in determining a profitable location.

A knowledge of the considerations and methods employed in the selection of a new factory location is valuable in certain phases of the management of a plant whose location is already fixed, such as in the securing of better transportation for employes and product, developing a better housing situation, finding prospective employes, etc.

It is also desirable to reanalyze the location of a plant from time to time, because conditions are constantly changing. A location which was excellent when the plant

MARKET		TRANS- PORTATION	MATERIAL	BUILDING	SITE	PRESENT		PROS- PECTIVE	
Location		Acreage available	Free land	Taxes—State, Municipal	Bonus				
Brick		Lime	Sand	Building stone	Lumber				
Labor		Carpenters	Bricklayers	Stone masons	Laborers				
Teamsters		Building costs for City A		Municipal building ordinances					
Steam coal		Coke	Grades	Pig iron	Analysis				
Steel		Machinery	Steel	Angle steel	Lumber for mfg.				
Malleable foundry		Paints	Boiled linseed oil	By water	Dockage				
By rail		Switch tracks and service	Belt lines connecting with trunk lines	Trucking	Demand				
Local by years		Local by districts	General by years	General by districts	Kinds of implements				
Land developments		Present acreage and crops	New acreage and crops						
PRODUCTION			LABOR			PRESENT		PROS- PECTIVE	
Population			Nationality						
Classes giving trouble			Labor available						
Labor organizations			Labor tendencies						
Rates			Machinists						
Laborers			Woodworkers						
Teamsters			Molders						
Painters			Blacksmiths						
Extent of piecework			Living conditions						
Cost of living			Rents—workmen's homes						
Proportion owning homes			Health						
Death rate			Training, Education						
Recreation			Street car service						
Have wages been increased or decreased in last three years?			Number of employees needed						
Women			Proportion employed						
Kind of work			Wages						
Minors			Age, Wages						
Hours by day and week			Shutdowns						
Fire service			Fire insurance						
Power			Water, Steam, Electric						
Water supply			Lighting						
Machine output by years			Unit cost						
Cost laid down at City A			Duty on machines exported to						

Figure 6. An analysis sheet prepared by an Eastern railway company to assist industries in analyzing the advantage of their present and possible future locations.

was built may in the course of time become a serious cause of high costs.

The location of a manufacturing plant, or business of any kind, should be periodically re-examined to determine if any location factors have changed sufficiently to make a new location desirable.

A tannery grew up and prospered for a time in a small town on Lake Michigan. In its early days, the hides were bought from the surrounding community, and the hemlock bark used in tanning them was cheaply shipped in by schooners from seemingly inexhaustible forests. Later, the farmers began to ship their cattle to the packers in Chicago, and the hides had to be purchased there. Then, the near-by hemlock forests disappeared, and hemlock bark had to be shipped in from long distances. Furthermore, as the town grew larger, taxes and other costs became higher. Profits dropped. The owners of the business, however, did not anticipate or seem to understand the true cause of their difficulty, which would have been plainly revealed by an analysis of their location in relation to their sources of supply. They staid on in that location until it was necessary to close out the business.

Another reason for re-examining a location from time to time is the fact that the relative importance of location factors often undergoes changes, frequently coming as the result of inventions and improvements in industry.

We have seen how power requirements and climatic conditions, which were once serious limiting factors, have become less important, while transportation costs have assumed much greater importance.

The thoughtful manager will use constructive imagination in studying such changes. He will, so far as possible, base his decision regarding location on the relative importance of each factor over a term of years rather than on immediate conditions. The telephone companies,

for example, locate a new exchange building where population promises to be densest ten years hence. Many an industry accepts temporary disadvantages for the sake of a location which, analysis shows, promises worth-while advantages in the future.

Location an Important Problem in Every Business. We have studied location factors particularly in relation to manufacturing, but they apply as well, tho with different weightings, to all kinds of business enterprises.

We saw the great importance of retail-store location in our study of show-window advertising. It is plain also that a wholesale dry goods house is a "manufacturer" of efficient warehousing and service. In determining its location, cheap power and climate may not count much, but almost all the other factors considered in preceding pages would have real weight in a decision.

No matter what business you are in, its location can be analyzed in the light of those factors. It will be profitable for you to review this part of this manual and estimate how important each factor is in the business with which you are best acquainted.

You will further develop your ability to handle important business problems by means of scientific analysis and investigation by working out Executive Problem 34. Use the following check-up as a review of the principles covered in this manual.

Executive Manual 35 will cover plant management and equipment; also control of stores of materials and supplies. Every business has arrangement and equipment problems; the more basic principles brought out in Executive Manual 35 apply in solving important problems of this kind in all lines of business.

CHECK-UP ON PRINCIPLES

Use the following check-up to get the principles of this manual firmly fixed in mind. This will help you to handle the problem which follows. This check-up is entirely for your own personal use, so you need not send it in to the University.

1. Where the purpose of organization is understood, is there likely to be such a thing as "overorganization"? Yes ☐ No ☐

2. The employment manager of one organization made it a point to tell every promising applicant for a position that the company's president had once been the office boy. This suggested that the applicant too might be president some day. Another employment man told only about the next steps of promotion ahead of each employe. Do you consider this a better plan? Yes ☐ No ☐

3. A typewriter-manufacturing company has a very thoro inspection system, with an inspector in each department who works under and reports to the department foreman. What form of control is this?

Line ☐ Line and staff ☐ Functional ☐

4. The manager of a large wholesale grocery had as one of his assistants a traffic expert who not only had charge of shipping routes, claims, etc., but who also had charge of all movement of the goods in the building whether by truckers, porters, or freight elevators. What is this form of control?

Line ☐ Line and staff ☐ Functional ☐

5. For years it had been the custom in the Jimson Company to give the employes a midsummer excursion trip down the river. The works manager is a little doubtful whether or not this is the kind of holiday the men enjoy most. At his suggestion, the employes this year appoint a committee into whose hands the manager puts the sum that is usually appropriated for the outing, telling them to use it for any kind of picnic they may prefer. What form of control does this illustrate?

Line ☐ Line and staff ☐ Functional ☐

6. A fire-protection expert is employed by a large railroad to travel over its system constantly, inspecting its fire-fighting equipment and keeping an eye open for fire-prevention and fire-protection features of all kinds. He sends daily reports to the general manager's office, where the necessary orders are issued to make the expert's suggestions effective. What form of control have we here?

Line ☐ Line and staff ☐ Functional ☐

7. Have you made a chart of some organization with which you are well acquainted? Yes ☐ No ☐

8. Do you find line control in part or all of the organization plan? Yes ☐ No ☐

9. Do any of the executives have functional control over work in more than one department? Yes ☐ No ☐

10. Is line-and-staff control to be found anywhere in the organization? Yes ☐ No ☐

11. Have you since reading this manual found new ways of organizing your own work or your tools? Yes ☐ No ☐

12. Refer to the lists on pages 29 and 30 of the executive manual. Check below the location factors which are important for the following industries:

Shoe manufacture

General location factors: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.

Factors which determine the local site: 1, 2, 3, 4, 5, 6, 7, 8, 9.

Airplane manufacture

General location factors: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.

Factors which determine the local site: 1, 2, 3, 4, 5, 6, 7, 8, 9.

Manufacture of high-priced watchcases

General location factors: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.

Factors which determine the local site: 1, 2, 3, 4, 5, 6, 7, 8, 9.

A brickyard

General location factors: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.

Factors which determine the local site: 1, 2, 3, 4, 5, 6, 7, 8, 9.

13. A group of business men making artistic household articles such as lamps plan a mail order outlet for their lines, and are considering Buffalo with its excellent mail service and many large-city advantages in comparison with Aurora, (N. Y.) near East Aurora and Oneida—both well known as centers of artistic craftsmanship. Check the factors which should weigh heavily in this choice.

General location factors: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.

Factors which determine the local site: 1, 2, 3, 4, 5, 6, 7, 8, 9.

14. Would you pick Buffalo? Yes ☐ No ☐

Executive Problem 34

LOCATING THE NEW FACTORY

Selecting the Most Profitable Factory Site UNDER THE LASALLE PROBLEM METHOD



IN AMERICA nearly everyone travels, and moving day is somewhat of an annual institution. Even factories move—something that in older lands is almost unknown.

But moving may be from good to worse as well as from good to better. It requires a most careful weighing of many factors to determine where in this broad land is the most profitable location for the plant that is moving, or for the new factory about to be built.



Prepared by the Research and Consultation Staff of LaSalle Extension University from an interesting problem which it has carefully investigated and analyzed.

Executive Problem 34

LOCATING THE NEW FACTORY

The Marshall Manufacturing Company is planning to build a new plant. The president and the works manager are making a thoro investigation; they have asked one of the executives to go to the three sites that are being considered, to gather all necessary data, and to make a report to them. This is an actual situation and we believe you will get the most out of it if you will serve as their representative.

The Company's Situation: The Marshall Manufacturing Company is an old-established New England corporation engaged in the production and sale of steam-fitting supplies. Its products are divided into five broad classes:

1. Tools, including wrenches, taps, dies, etc.
2. Cast-iron fittings, including elbows, tees, valves, etc.
3. Malleable-iron fittings, including much the same line of products, but which are lighter than cast-iron.
4. Brass goods, valves, and fittings for water and steam pipe systems.
5. Power-plant accessories, such as grease cups, oiling systems, and the like.

The factory is located on the Eastern seaboard, a situation which has been ideal up until the past few years. Distribution is maintained thru branch offices and warehouses located in various Eastern cities and in Pittsburgh, Atlanta, Chicago, St. Louis, Kansas City, Dallas, Denver, Seattle, and San Francisco. Shipments are made in carload lots direct to the branch warehouses, from which they are distributed to the users.

Due very largely to high freight rates and the time required to make delivery, the location of the factory in

the East is becoming quite a handicap. Competitors whose factories are located near the branch offices are getting an increasing share of the business, owing to their ability to quote lower prices and to furnish quick deliveries with less capital tied up in inventories. The situation is becoming especially alarming in the Chicago territory where, in spite of increased building activity, the percentage of the total sales secured by the Chicago office to the total volume of sales in the territory covered by the Chicago branch is decreasing every year.

The margin of profit is also very low, because the selling prices must meet the prices of local competitors who do not have to figure freight charges in their costs.

Obviously, something has to be done. A thoro investigation has shown that no great reduction in production cost can be effected in the factory. Only by moving the factory closer to raw materials or closer to where the products are being actually used, or both, can cost be reduced sufficiently to meet competitors' prices and still show a good profit.

It has been decided, therefore, to locate a plant at some strategic point for the purpose of manufacturing cast-iron and malleable-iron fittings, which constitute 45 per cent of the total manufactures, and on which, owing to weight and proportionally low prices, freight charges represent an important part of the total cost. Brass goods, tools, and accessories on which, owing to lesser weight and higher prices, freight rates play a less important role, will continue to be manufactured in the Eastern factory, which will also make enough fittings to take care of Eastern and export trade.

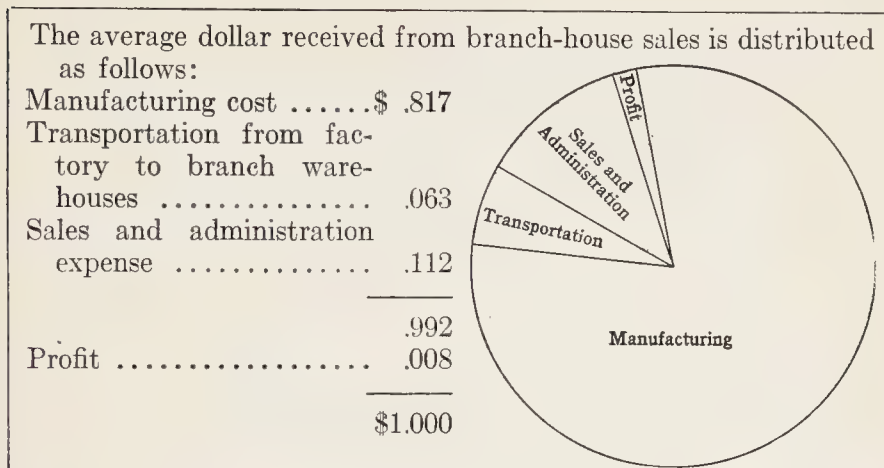
The new plant is to be capable of producing seven hundred and fifty tons of cast-iron fittings a month and one thousand tons of malleable-iron fittings.

The Preliminary Survey. Before going out to collect the needed data, you make a survey and analysis of the present situation. The sales department supplies you with records of the business done by each of the branch houses in the lines which interest you, and also quotas which has been assigned to each for the coming year. (You will find these quotas in the working papers.)

From the traffic department you get the freight that has been paid on this material from factory to branch house, and also the freight rates for similar shipment from each of the cities considered. (These are shown on the working papers.)

From the accounting department you get data which enables you to compute the total sales in these lines made by all the branch houses involved, the sales and administrative cost, and the manu-

facturing cost. This enables you to compute the proportion of each to the selling price, a relation that is well shown in the following chart and "sales dollar" diagram.



You find also that about fifteen acres of land will be required for the present plant and for reasonable future expansion, and that attractive offers have been received thru various organizations. These have been sifted out and three are receiving serious consideration; one from Keokuk, Iowa; one from Birmingham, Ala.; and one from Chicago, Ill.

You also have a conference with the company's chemist and learn that satisfactory iron for the making of the malleable-iron fittings can be obtained for these factories in Ohio and in the Chicago district, and that pig iron for the cast-iron fittings is obtainable both in the Birmingham district and in the Chicago district. He also gives you pointers on the coal, coke, and gas requirements.

Armed with all this information and with your definite objective (low cost at the ware house door) constantly in mind, you start your investigation.

The results are summarized as follows:

A SUMMARY OF THE INVESTIGATION

Plant

Chicago. On account of the failure of a similar manufacturing company, its plant and equipment can be purchased for \$800,000, a sum made up of \$150,000 for land, \$300,000 for buildings, and \$350,000 for equipment. The site covers twenty acres. The buildings, while not modern, are well constructed and can be readily adapted to the requirements of the Marshall Manufacturing Company. A power plant is included, capable of developing sufficient

power for all manufacturing requirements, and requires but slight repairs and overhauling. The cost of producing power is estimated at \$35,000 a year. Local taxes at this location are high—about \$9,500 a year.

Much of the equipment can be used, thus making the purchase of new equipment unnecessary until the old is worn out. However, due to many months of idleness it will require overhauling and considerable repairs, the cost of which is estimated at \$50,000.

Keokuk offers to furnish required land free as an inducement to locate in that city, with the provision that power be purchased from the Keokuk Dam power station. Taxes in this locality are very reasonable; about \$1,500 is the estimate for the immediate future.

Thoroughly modern types of buildings with a complete heating and sanitary system will cost about \$500,000. No power plant will have to be erected, but the annual charge for electric power will run about \$15,000 a year.

The cost of fitting out the plant with new equipment will be about \$600,000.

Birmingham. A satisfactory site can be secured for about \$30,000. Taxes are quite reasonable—about \$3,000 a year.

Because of the mildness of the climate, no heat will be required in the buildings and they can be of less substantial construction than either Chicago or Keokuk. This reduces investment in buildings to about \$325,000. To this must be added the cost of a power plant, which will be \$100,000. It will cost approximately \$30,000 a year to produce the necessary power.

The cost of equipment will be the same as for Keokuk.

Materials

Chicago. A plentiful supply of coal is available from Illinois and Indiana fields, but is of relatively low grade. Pig iron and malleable iron are readily to be had.

Keokuk. Pig iron and malleable iron will be obtained from the same sources as for Chicago, at a somewhat greater cost because of the longer haul. Coal and coke will be supplied from the Illinois and Indiana fields, and gas from the local plant. Freight rates and cost of handling coal and coke are approximately the same as for Chicago.

Birmingham. Cheap coal, coke, and gas are available from the Birmingham fields. Pig iron is produced in this district and transportation charges on this material are therefore low. Malleable iron is still being brought in from Northern fields. In this connec-

tion it is well to consider that improved methods and demand may result in the development of a method of producing malleable iron in the Birmingham region.

Labor

Chicago. A large supply of all classes of labor is available, but it is very unstable and wage rates are high. The efficiency is in general good, however.

Keokuk does not have a large labor population. Much of the required labor will have to be brought in. Once there, however, they will be more apt to remain than in a large city. There are few big-city attractions for high-class labor. The cost of living is less than in Chicago.

Birmingham. Negro labor is available for most of the work done in this plant, except machine work. It is not as efficient as white help, but costs less per hour. Living costs are comparatively low and the city offers many attractions to high-grade labor.

Manufacturing Costs

You inquired fully into the comparative cost of manufacturing similar products in all these cities. This has given you data from which you have computed the direct and indirect labor cost per ton of product for such a plant as yours, and have added to this the expense of fuel, of maintaining the plant, etc. The estimated totals are shown in the working paper.

Transportation Facilities

Chicago. These are excellent as the plant is located on two trunk lines, and is connected by a belt railroad to every railroad running out of Chicago, and also with the Chicago warehouse. From one to two days may be lost, however, when switching over the belt railroad is necessary.

Keokuk. Four railway lines offer adequate transportation facilities, and closer contact can be maintained with local railroad authorities than is possible in the other locations. The time in transit is likely to average about the same to most points as from Chicago.

Birmingham. Nine railways furnish adequate transportation facilities, but it will take several days longer to reach most of the branches. Birmingham has the advantage of no delays from winter weather conditions, but this is somewhat offset by flood embargoes when the Mississippi or Ohio rivers are out of their banks. There is likely also to be more delay in shipment when the railroads are overtaxed.

Both Chicago and Keokuk have the advantage of water transportation. The site in neither city, however, is on a waterway.

Markets

In selecting a site for the plant, the many possible developments in the marketing situation are not being considered. It is assumed that there will be a healthy growth in the business of all the branches and that no field is likely to outstrip the others materially.

The selling prices will in all cases be quoted f. o. b. the nearest warehouse and will always have to be such as will meet competition. In many ways, therefore, the plant location has no effect on marketing.

Nevertheless, there is such a thing as local pride and prejudice. This is especially true for Chicago. A slight preference exists in favor of goods manufactured locally, compared with goods made in Keokuk or Birmingham. Outside of Chicago, the prestige value of the different manufacturing points will have slight weight.

Taking into consideration the information which is given regarding those locations, how do you size up the three propositions, and which would you select as the most advisable point at which to locate the proposed plant?

The working papers contain certain data regarding freight rates, and a form which will prove helpful in arranging all the data and working out the comparative costs.

